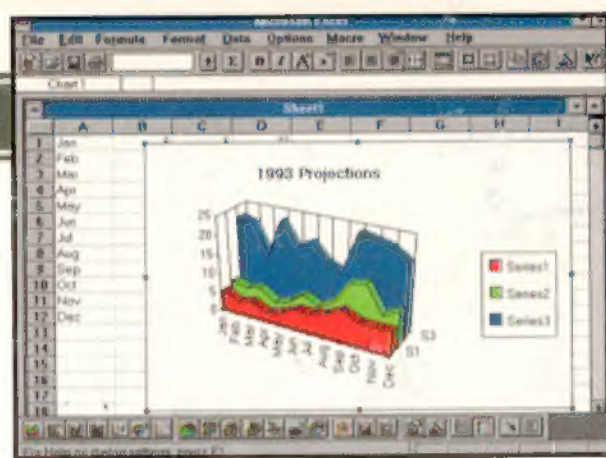


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DOS Word Processors Still Thrive! More Dash, Less Flash

APPLICATIONS DEVELOPMENT

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MAGAZINE

MAY 26, 1992

THE INDEPENDENT GUIDE TO PERSONAL COMPUTING

VOLUME 11 NUMBER 10

1992 PC MAGAZINE SURVEY

SERVICE & RELIABILITY

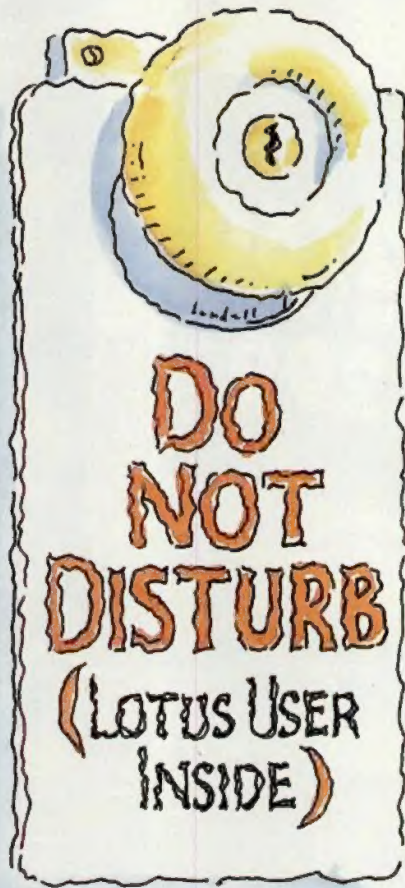


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Inside

In the past year, development tools like Microsoft Visual Basic and Borland's ObjectVision have made it easier than ever for corporate users and commercial developers to create applications. As operating environments get increasingly graphical and object-oriented, tools promise to get even better. And the audience for them will get even wider. That's why we've established a new editorial team to review development tools, operating systems, and programming languages—all of which previously had to compete with applications for attention from the software team.

In this issue, the applications development team looks at five xBASE development systems, including *dBASE IV 1.5* (a minor upgrade to the best-selling database program). "xBASE is the most popular database language in corporate computing," says Stephen W. Plain, PC Magazine Labs' project leader for the team. "Here, we look at *dBASE* and some rival programs aimed at the large group of xBASE developers."

While Sal Ricciardi, author of our Databases column, reviewed the packages for real-world potential, Plain rolled up his sleeves and ran the performance tests. "First, I modified the multiuser database benchmark tests for the xBASE world," he explains. "The tests include database tasks: indexing,



queries, and network stress tests, among others. I distributed the new spec to the vendors, who developed code that was optimized for performance in their native languages. To make sure we did justice to each product, I worked with the vendors to fine-tune the code, and then ran the tests."

This was by no means the first time Plain had tested products for a *PC Magazine* roundup. As a systems support specialist and, recently, as the

senior technical analyst, Plain has tested much of the hardware and software that has come through PC Labs over the past three and a half years, from PCs and peripherals to operating systems and anti-virus packages.

Later this year, Plain and associate editor Sheryl Canter will tackle stories

on visual programming tools, C++ compilers, SQL-based client/server products, and—you guessed it—more databases. If you're looking for new tools, you'll find reviews of new products in the Toolkits column, edited by senior editor Trudy Neuhaus.

Also in this issue are the results for the hardware portion of our second Service and Reliability survey; software results will appear in the next issue. More than 8,500 readers responded to the survey, underscoring once again how much PC buyers care about service and support.

—Mary Kathleen Flynn



Stephen W. Plain, a project leader at PC Magazine Labs, tested the xBASE database systems reviewed in this issue.

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Attention All dBASE Users: Your Windows Have Arrived.

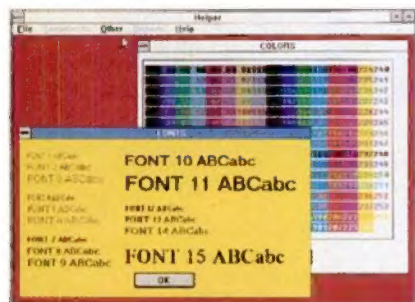


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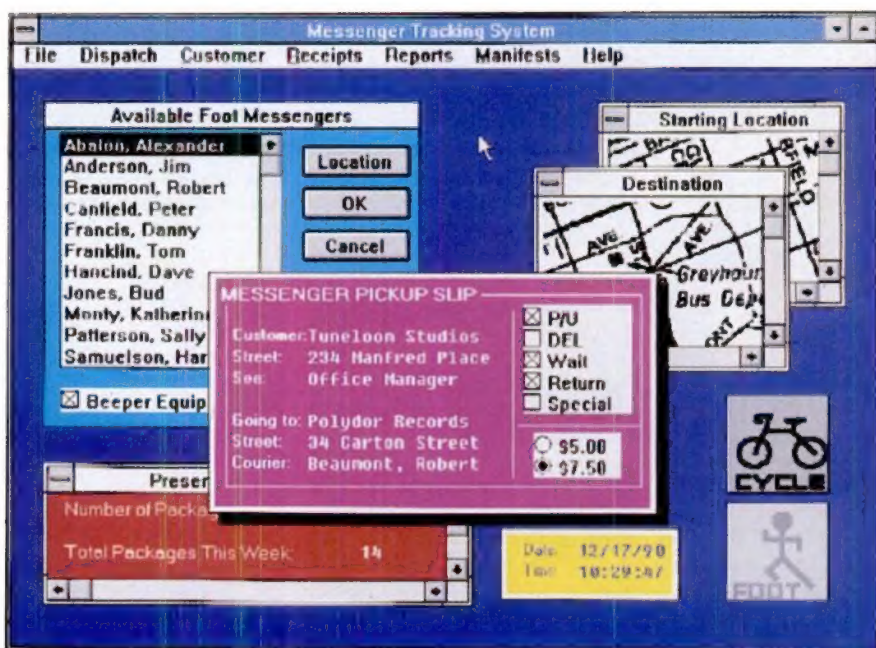
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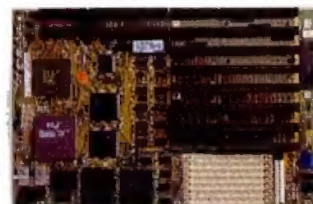




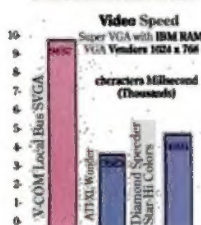
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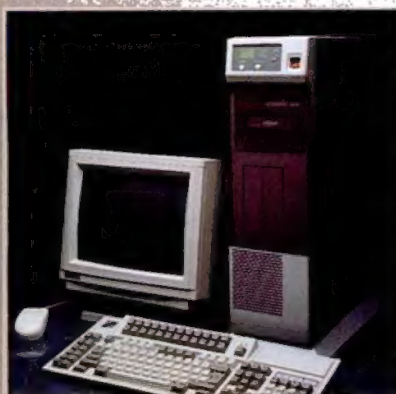


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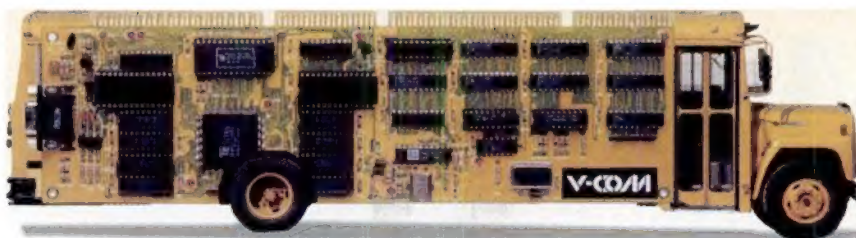
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Michael J. Miller/ When you buy a PC, you're buying a company, too: its reputation for producing reliable computers, its service and warranty policies, and its ability to answer your questions when you call. In our 1992 Service and Reliability Survey, more than 8,500 computer users told us how happy they have been with the companies behind the computers.

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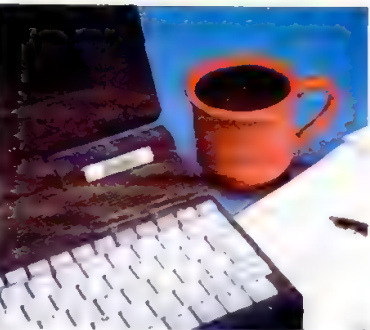
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CIRCLE 360 ON READER SERVICE CARD

Letters

THE 386 IS NOT DEAD!

Editorial or no editorial, Bill Machrone's column "The 386 Is Dead" (March 17, 1992) reeks of Ziff-Intel pillow talk more foul than anything else I've ever read! While there is no doubt the 486 outperforms most 386 systems, a blanket statement such as "The 386 has no future" is ridiculous. Those of us in the real world base our hardware purchases on software and price/performance issues. With the 386 finally being cloned, this represents one of the most significant benefits to end users in years—namely the loss of Intel's monopoly on the 386, which serves to further reduce computer prices.

The whole idea of Intel selling crippled versions of its CPUs (SX chips) is proof positive of P. T. Barnum's immortal statement, "There's a sucker [corporate MIS buyer] born every minute." But what really disgusts me about this issue is that if these efforts are successful, then gone will be the days when a product shines as a result of its excellence, as opposed to the resources and intimidation tactics of the company's ad agency.

Neil Olsen
Metairie, Louisiana

Bill Machrone suggests that the 386 is going the way of the dinosaurs and everyone should think 486. Tell me something: Why should I get a 486 when the 586 is around the corner? And why should I get a 586 when a 686 is almost here? Since your magazine has nothing good to say about the machine I have (a lowly 286), I will have to go it alone.

Jim Yarman
Clearfield, Utah

I have one question to ask Bill Machrone: Do you have a 486 with a huge hard disk, massive amounts of memory, and a blistering fast VGA card?

Unfortunately, the vast majority of PC users do not get paid to play with gigacomputers. Sure I want a 586/50 for a server, 486/100s for workstations, and



NetWare 9.0, but what I have is something Machrone thinks is dust and ashes (a 386/25 server, NetWare 2.0A, and a slew of XT workstations).

Let the needs define the computer, not the other way around. If all of us were power users, then there would be only 486/50s. But until the "casual users" are brainwashed, there will still be room for the 386 and (gads, no!) even the 286.

James P. Nunes
New York, New York



No one's suggesting you junk your 386s or even your XTs if they're getting the job done. But you'd be crazy not to buy a 486 the next time you need a computer.

—Bill Machrone

WINCHESTER-WISE

I would like to correct Richard W. Dickinson's letter (Letters, March 17, 1992) about "creating and perpetuating a myth" concerning IBM's "Winchester" hard disk technology. The IBM 3340 (not the 3330-1) was the first mainframe disk drive to use this technology, and it had

the head-disk assembly (HDA) packaged in a removable data cartridge. Originally, in the prototype versions of the 3340, each data cartridge could store 30MB of data, and the drive frame held two data cartridges. This 30-30 arrangement led to the name "Winchester," from the famous 30-30 rifle. The rifle maker's estate (the Winchester Mystery House) is located in San Jose, the home of the IBM facility that developed the 3340.

Dr. Ken Haughton (formerly with IBM) is considered by most in IBM to be the father of the Winchester technology. I know because I was part of the team that developed the control unit (3830) for attaching the 3340 to the System 360/370 host systems. I was present at the meeting when the Winchester name was given to the technology.

Phillip Clark
San Jose, California

5.25-INCH FLOPPIES ARE ALIVE AND WELL

Here's further evidence that John C. Dvorak is sometimes full of it. In his column on "dead-end trends" (February 25, 1992), he states that "few machines even come with 5.25-inch drives any longer." I counted more than 30 computers in ads in the same issue of your magazine that clearly show 5.25-inch drives installed—and this was only in the pages before his comments!

David Nebenzahl
Palo Alto, California

CRYING FOR TECH SUPPORT

This is in response to Gary Bresau's letter of February 11, 1992, concerning crybabies who need to call product manufacturers for help with a problem that they cannot figure out themselves.

My first thought is that Gary Bresau is just another typical computer snob. After some thought on the subject I've changed my mind. He must be a real man. A rugged John Wayne individualist we should all look up to. I'm thinking of

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CIRCLE 325 ON READER SERVICE CARD

Letters

getting rid of my computer because I don't have what it takes to be as resourceful as Mr. Bresau. After all, I'm one of those crybabies who call tech support now and then.

Maybe I'll keep my computer and plod along, doing the best I can, feeling somehow comforted knowing there are greater intellects out there.

Bryce Andersen
Chicago, Illinois

BASEBALL BONUS

I must say that I was ecstatic when I read your February 25, 1992, Advisor column. To see my program, *Baseball Statistics Manager*, discussed in your magazine was a delight.

It is important to note that the latest version of the program is 02.95 and is available on CompuServe under BSM295.ZIP. It includes HP printer support, a custom report writer, Little League support, and a few other features requested by my users.

BSM 03.00 Deluxe is under development and should be completed in December.

Barry Smith
President, Caboose
Software Engineering
Silver Spring, Maryland

AN IDEA FOR WINDOWS

Every issue of *Family Circle* has a diet story, and now every issue of *PC Magazine* has an article on how to speed up Windows. How about putting it on a fast train over a high cliff?

Bruce Miller
Derby Line, Vermont

SEPARATION OF SHAREWARE

I agree with Scott Bigler (Letters, January 14, 1992): I think it would be great to see separate shareware reviews. I know that on occasion you have reviewed shareware alongside commercial programs, but a section dedicated to shareware would be a great addition to an already great magazine.

John Meyer
APO



PC Magazine's policy is to review shareware with the same criteria we use for commercial products. Users want to know

whether the software can do the job, not how it is distributed. Reviewing shareware in a separate category would imply that it cannot compete with commercial products.—Ed.

PUT AN INDEX IN EVERY ISSUE!

Thanks for the 1991 index (January 14, 1992). We have been waiting for it for years. We would also like to see a running index: Each issue should have an index for the current year to date. It would be nice not to have to wait until next January for the 1992 index.

Michael Heisler
Ithaca, New York

WHOSE PROBLEM IS IT?

It is amazing that people smart enough to operate computers are unable to connect our remarkable technologies to their less pleasant consequences. John LeRoy Johnston III (Letters, February 25) complains that "they are taxing the air in California." So he's moving to Nevada. Doesn't Mr. Johnston see that the evolution of faster and cheaper PCs is directly linked to the congestion, pollution, toxic waste, and taxes of states like California?

If he doesn't like taxes, has he run for public office? Has he stopped driving his car to reduce pollution? Does he operate his PC off solar cells? Perhaps he thinks a couple of guys in a Winnamucca garage can mass-produce 386 chips? Or does he, like so many others, think it's all someone else's problem?

David Hagan
Richland, Washington

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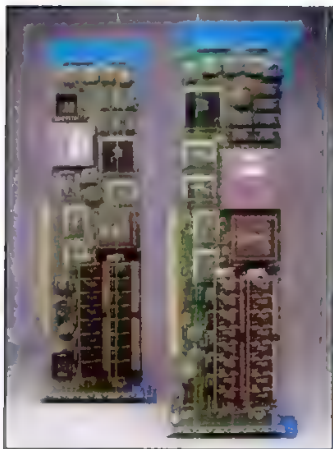
We were greatly disappointed by your review of our product *The Text and Attribute Editor* in the February 11, 1992, issue ("19 Programs That Build on AutoCAD"). You seem to think that all AutoCAD users have upgraded to Release 11 and are immediately ready to run ADS applications. If you were an applications developer, you would know that this is not the case. Every day we receive telephone calls from users who are on Release 10, Release 9, or older versions of AutoCAD. This is why Marcomp's *The Text and Attribute Editor* is compatible with versions of AutoCAD back to 9, and why our product is not written as an ADS application.

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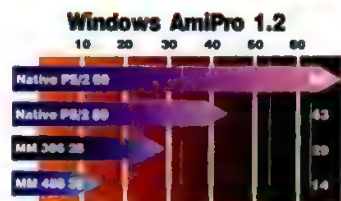
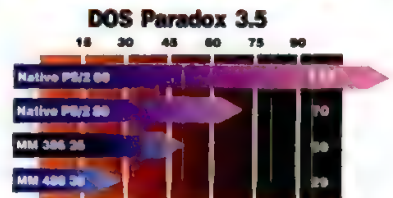


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PC WEEK REVIEWS



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Letters

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Matt Richards
President, Marcomp
Parkton, Maryland

DON'T FORGET BBS NUMBERS
As a LAN administrator and PC troubleshooter, I often need to access the bulletin board systems that most PC

hardware and software companies establish. Whether it's for finding the most current LAN drivers or finding documentation for a user's four-year-old tape drive controller, access to these BBSs is a valuable tool in any PC guru's kit. You could do your readers a great service by publishing or posting on PC MagNet the BBS phone numbers of as many hardware and software companies as possible. For smaller companies in particular, it is often hard to find a BBS number when you need it.

A. J. Fried
West Paterson, New Jersey

CORRECTIONS & AMPLIFICATIONS

A number of readers have complained to us about the scarcity of the Diamond Computer Systems Stealth VRAM card, which won our Editors' Choice award in "Graphics Accelerators: Pump Up the Power," March 17, 1992. Some also reported that they could not duplicate the performance results we obtained in our published tests. We questioned officials at Diamond and at a number of major distributors. We also retested several samples of the Stealth VRAM.

We have determined that the Stealth VRAM card did ship in limited quantities to the retail market in November 1991. According to Diamond, about 1,700 cards with an alternate clock chip were also sold in late November and December 1991. These boards were 10 to 15 percent slower on PC Magazine Labs' WINBENCH 2.01 benchmark tests than the product we tested. Diamond halted shipments of its Stealth VRAM for a time in January because of compatibility problems in the BIOS and in its Windows and AutoCAD drivers. The problems have now been fixed, and the product is widely available.

Diamond will replace any of the slower boards with the current version. The slow Stealth board can be identified by the words "Speedstar VRAM Rev. C1" on the circuit board and BIOS version number 1.00 or 1.11. The faster boards bear the name "Stealth VRAM Rev. B2." The current BIOS version is 2.14. Diamond will supply BIOS upgrades free of charge. Contact Diamond Computer Systems at 532 Mercury Dr., Sunnyvale, CA 94086; 408-736-2000.

In the November 26, 1991, printer blockbuster, we reviewed two Epson laser printers and compared the 65 fixed-size bitmapped fonts in the HP LaserJet-compatible EPL-7000 with the 35 scalable fonts in the PostScript-based EPL-7500. In stating the "EPL-7500 could be improved by gaining ... the extra fonts [of the EPL-7000]," we made an error, since the EPL-7500's 35 scalable fonts are more flexible than bitmapped fonts.

In reviewing the Kyocera F-5000A, a shared laser printer with B-size (11-by 17-inch) output, we unfairly concluded that "you can do better elsewhere in both price and shared performance." *PC Magazine* should not have compared the Kyocera F-5000A with inherently cheaper A-size printers (8.5-by 11-inch output). At \$7,995, and with throughput exceeding its claimed 12-page-per-minute speed, the F-5000A represents very good price/performance for a B-size printer.

Eclipse Technologies' *Madison Ave.* (First Looks, March 17, 1992) requires 1.2MB of hard disk space for installation, not 3MB as was reported.

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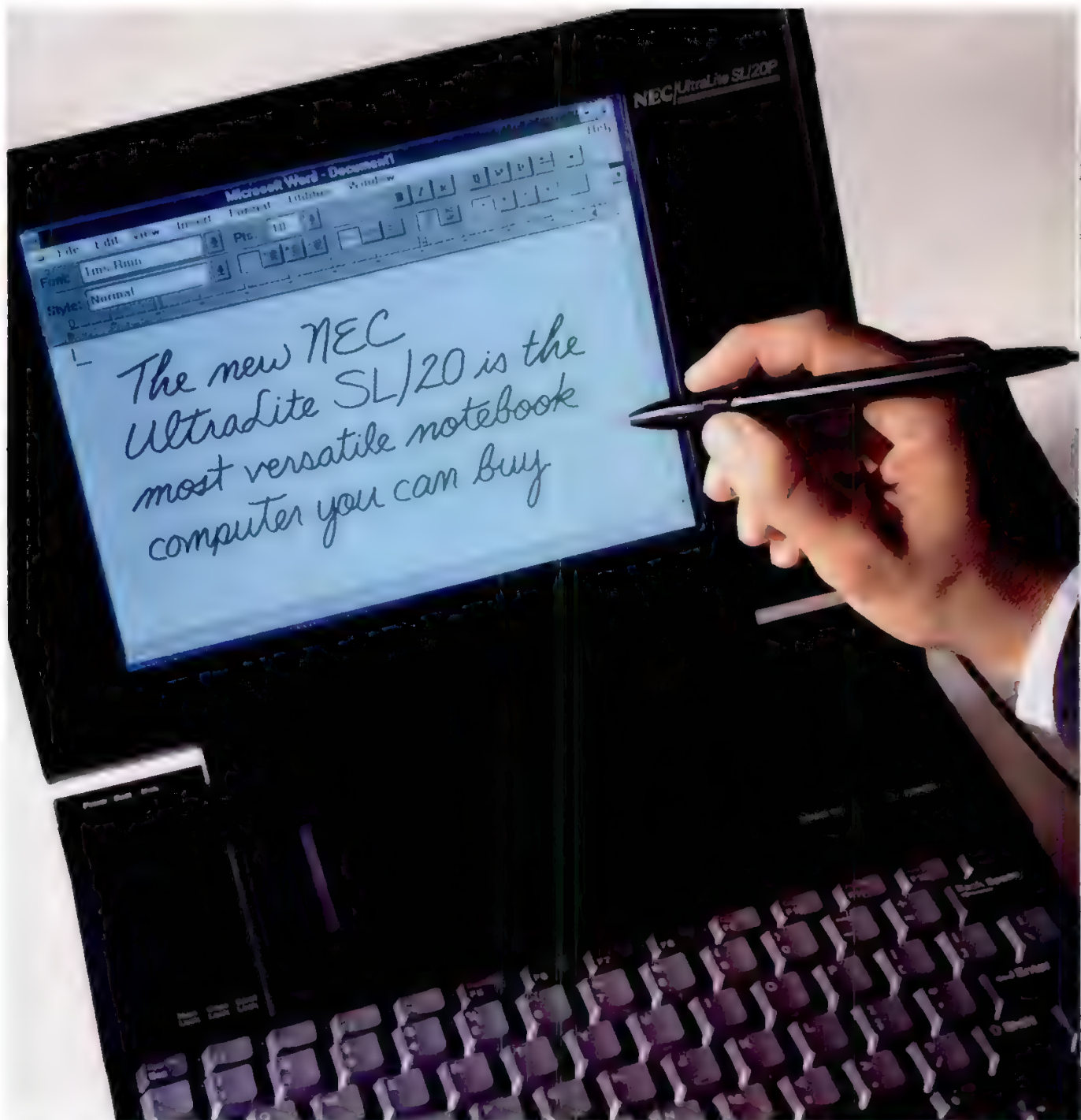
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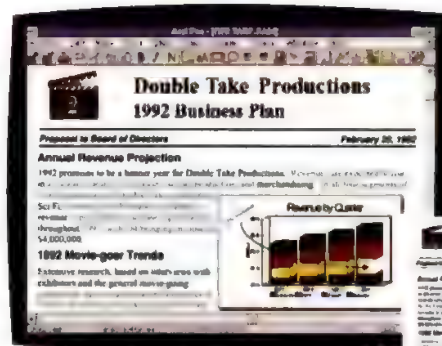


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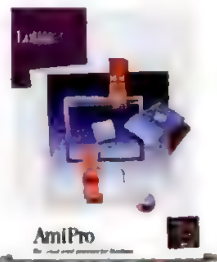
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Trends

Trends & Technology Shaping the Personal Computer Market

Digital Signal Processors Promise Multimedia—Cheap

Multimedia is about to get a big boost from a single inexpensive multipurpose chip: the digital signal processor. Priced on a par with modem chip sets, the new DSPs from Analog Devices, AT&T, Motorola, and Texas Instruments can handle it all: fax-modem, voice mail, speech recognition, stereo sound, and image compression. Later this year, you'll be able to buy add-in cards and new PCs with any or all of these functions.

For ten years, application-specific DSPs have been used in everything from telephones to cars. In sports cars, DSP-based "mufflers" cancel out engine noise and DSP-based "shock absorbers" respond to bumps in the road with equal and opposite forces. In the PC arena, DSPs are currently used in high-speed modems; a Motorola DSP is built into the NeXT machine and a DSP from Analog Devices handles the audio portion of Intel's Digital Video Interactive (DVI)-based ActionMedia 2 Delivery Board.

A DSP is best thought of as "a funny floating-point processor," says Steven Edelson, architect of the Continuous Edge Graphics chip and founder of Edsun Laboratories. Like RISC chips and math coprocessors that are optimized for certain functions, DSPs have a set of signal processing commands built in. "They're really good at doing certain kinds of computations, like filtering. And they're fast enough to keep up with sound, for instance, in real time," says

Edelson. This ability to perform complex algorithms in real time is what makes DSPs suited to multimedia applications such as image compression and speech recognition. Another advantage is their programmability.

Analog Devices recently announced DSP chips optimized

CONTINUES ON PAGE 32

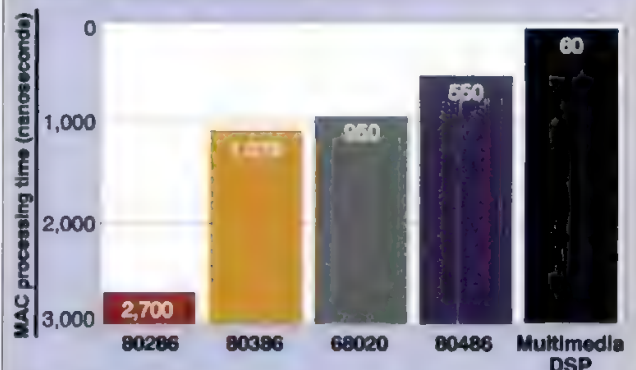
A New CPU Every 18 Months?

In the PC industry, customers have gotten used to a new generation of microprocessors every three years. The next generation is likely to arrive on schedule: Intel's next CPU, code-named the P5 (probably to be called the 586), is expected this summer. But future generations may show up more quickly.

Faced with increased competition from new RISC chips that are expected to be able to run standard software, Intel's follow-up to the P5 will probably be out 18 months later. Code-named the P6, it will probably be called the 686 and should have even more RISC-like features

With built-in commands such as multiply and accumulate (MAC), DSPs can process digitized waveforms (such as sound) much more quickly than x86 chips. For example, a DSP can process a MAC nearly ten times as fast as a 486 chip.

DSPs: Made for Multimedia



Source: Texas Instruments

than the P5. And the P7, another generation, is expected about 18 months after the P6.

According to Dave House, Intel's senior vice president, the P6 is halfway through development. Intel can turn a new generation out faster than in the past because, he says, "We are devoting more spending and more teams to development."

Rated at 100 mips (million instructions per second), the 586 (P5) is expected to be 2.5 times faster than the 50-MHz 486 DX2, and industry sources expect the P6 to be another leap forward. It's too early for any details on the P7.

Intel has been facing more competition in the mainstream chip market. Meanwhile, Windows NT will run on MIPS's R4000 RISC chip, and Microsoft has endorsed DEC's new Alpha RISC chip.

Are we ready

for two advances in chip generations in the next two years? Intel is counting on it. "Customers certainly say they're ready," said House. "They're beating down our doors."

Michael Slater, editor of *Microprocessor Report*, thinks he knows why chip customers would want another CPU so quickly: "In 18 months, the market won't be crying for something to replace the P5. But the P6 probably won't be aimed at the same customer as the P5. The P6 may let customers build systems with fewer parts or do other things to decrease cost. You can't move the mainstream market that quickly, but you can at the high end."

—Christopher Barr

Databases: Round 2

You might think the database market is shrinking. Certainly the number of players is, as Microsoft and Fox Software get ready to merge just



Pipeline

by Gus Venditto

Death of NetWare 2.2 Exaggerated



After years of building a reputation for flawlessly anticipating users' needs, Novell seemed to have stumbled recently. First, a top executive was quoted as saying the company's most popular platform, *Advanced NetWare 2.x*, was being put out to pasture. And then several weeks later, articles appeared saying Novell had recanted and was now promising to build new features into the series.

What gives? Did Novell lose its nerve after making a decision that we've been expecting for years? Since the debut of *NetWare 3.x* (originally called *Advanced NetWare 386*) in 1989, Novell's biggest customers have known all along that the future belongs to the 386-based network operating system. Right from the beginning, it had the built-in hooks and options needed for long-term growth. It can support hundreds of users on a server. Its NLM (*NetWare Loadable Module*) strategy provides for limitless extensibility. It can dynamically allocate resources. And it's where Novell has deployed the greatest amount of talent. The birth of *NetWare 3.x* made many customers believe that *NetWare 2.x* was on its deathbed, even though Novell took pains to explain that the 286-based series would stay on the market. Those explanations were always surrounded by glowing tributes to 3.x and its role as a beacon to the future, so it's easy to understand why some people have been a little uneasy in dealing with 2.x—they felt as if they were visiting a sick friend.

To date, most of the *NetWare* faithful haven't rushed to embrace 3.x; the earliest releases were plagued by bugs, and there's been a general wait-and-see attitude. But enough installations have made the upgrade so that Novell views 3.x as a success. Compared with the number of sites switching to *VINES* and Microsoft's *LAN Manager*, *NetWare 3.x* is a runaway hit. Yet *NetWare 2.x* still represents the lion's share of Novell's customer base.

Even most 2.x administrators believe the future belongs to *NetWare 3.x*—a situation that sometimes makes Novell act a little impatient about getting everyone there *right now*. Which is how the company happened to create the impression recently that it was finally going to pull the plug on the 2.x series. It cut prices on entry-level versions of *NetWare 3.11* and raised prices on 2.2. It began to show early versions of 3.2 and moved a team of programmers off 2.x development. And a Novell executive gave the same kind of *NetWare* forecast that the company has been making for years.

The fact is, Novell wishes that 2.x would finally die, but it's not foolish enough to betray its customers. Enhancements are in the works, including new printing, backup, and security features. And the company set up a new *NetWare* Software Maintenance Program to distribute the updated code on-line.

While the recent episode may be embarrassing for Novell, it's also a sign of what's right with the company and why its future remains bright. Even though it owns more than half the network operating system market, Novell remains responsive to its customers. Novell will have its hands full keeping Banyan and Microsoft at bay. It doesn't need to turn its customers into enemies, too. ■

Gus Venditto is a contributing editor to PC Magazine and the editor of PC Sources magazine.



as Borland and Ashton-Tate did last year. But database technology promises to proliferate as environments get more database functionality and applications get more querying tools. Databases themselves should get easier to use, with all of them speaking the same languages, as they migrate to Windows.

"Database penetration has declined from 25 percent of all PCs to 15 percent," says David Fulton, the president of Fox Software who will become Microsoft's database architect (assuming the merger gets government approval). "In the eighties, we focused on improving development languages. But in the nineties, the emphasis will be on improving performance and ease of use to bring databases to a broader user base." According to Fulton, Fox's "emphasis on speed and Microsoft's emphasis on graphics and usability make a very good match."

For the foreseeable future, Microsoft, like Borland, will have two database product lines: *FoxPro*, a Windows version of which is due this year, and an upcoming Microsoft product code-named Cirrus, which will begin beta testing shortly. As with future releases of Borland's *dBASE* and *Paradox*, subsequent releases of Microsoft databases will "cross-pollinate each other," says Microsoft CEO Bill Gates. Exactly how the two will be differentiated isn't entirely clear, except that *FoxPro* (like *dBASE*) is Xbase-compatible; whereas Cirrus (like *Paradox*) isn't. (See "Xbase Development Systems" in this issue.) What's potentially exciting about Cirrus is that it may incorporate object-oriented event-driven techniques like Visual Basic's.

According to Gates, the merger complements Microsoft's *SQL Server* product and the company's Open Database Connectivity (ODBC) technology, which will give applications access to underlying databases. Borland's counterpart is the Interbase strategy, where front ends can access information regardless of the application.

So as the players team up, where is Lotus on the database roster? Lotus is embedding more database functionality into the *Notes* workgroup environment and developing querying tools such as the upcoming front end, code-named Notebook.

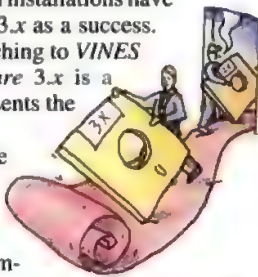
Microsoft's Gates sees database technology becoming more ubiquitous. "You're certainly going to see more integration of query tools in applications," says Gates. "And the database engine will be increasingly built into the operating system. But you're always going to see reporting and forms design tools to build apps. What product you buy will just depend on the amount of querying you want to do."—Mary Kathleen Flynn

Ink Jet Printers For \$300

At \$700, ink jet printers were the poor man's lasers. But as their street prices plummet to \$300 later this year, they'll make serious inroads into dot matrix's most valuable territories: the home office, the small business, and the individual user. By autumn, you'll see at least a dozen \$300 ink jet printers that offer near-laser quality at 24-pin dot matrix prices. And many of them will be portable.

The price drop doesn't come from any technological improvements, but more as a consequence of economics: Manufacturers know that for ink jets to remain viable, there must be a wider gap separating them from low-end lasers, which are now priced as low as \$700.

Inexpensive ink jets are already arriving. Canon crested the



wave almost two years ago with its \$499 BJ-10e. Though the BJ-10e is a truly portable printer, it can certainly perform adequately on a single user's desktop. Canon has also been actively seeking OEM partners. The result is Star Micronics' StarJet SJ-48 and Brother International's HD-100i. Both printers carry the BJ-10e's chassis and \$499 list price tag, but can be found in mass-market channels and office superstores for about \$300 to \$330. They also offer slight performance tweaks and increased warranties.

The other ink jet giant, Hewlett-Packard, has also lowered its prices. The DeskJet 500, which listed for \$729 two years ago with a street price around \$500, now lists for \$599 and sells for about \$400, while its color-printing cousin, the \$1,095 (list) DeskJet 500C, is available for \$600.

Eastman Kodak won't be left out, either: It's introducing the new low-cost Diconix 701. Weighing only 6 pounds, the printer is certainly portable (it runs on an AC adapter or nickel cadmium batteries), but with features like a built-in sheet-feeder and internal font rotation, it seems aimed at the desktop rather than the suitcase. At \$549 (list) with an undetermined street price, Kodak is moving squarely into the home-office/single-user market.

Close behind are Olivetti and one of its divisions, Royal Consumer Electronics. Both organizations are marketing the same printer, a \$499, 6-pound, 160-character-per-second compact unit called either the Olivetti JP-

150 or the Royal CJP-450. Both versions will be marketed through resellers and mass-market channels with street prices around \$299.

In addition to the low prices, the current economy may attract more business users to ink jets. Christie Stevenson, director of product development at Royal Consumer, points out that the new low-priced ink jet is eminently suitable for middle management: those who want laser quality without printer sharing or network hassles, but whose budgets don't allow for a personal laser on every desktop.

—Oliver Rist

DRAM Gets a Pep Pill from Rambus

A new memory chip design called RDRAM, from Silicon Valley start-up Rambus, will let PC designers make faster, smaller, and less expensive systems that require fewer parts. The RDRAM design from Rambus moves up to 500MB of data per second—ten times the current throughput—obviating secondary memory caches that have been added to high-performance PCs because DRAM memory speeds haven't kept pace with CPU speeds.

PCs are priced at a multiple of their component costs, and with no cache controller or external RAM caches required, manufacturers and buyers will save money with the design. The RDRAM is based on the normal DRAM design and is much

cheaper to manufacture than the static RAMs, commonly called SRAMs, that are often used in caches.

Your eyes will benefit from RDRAMs, too. Graphic subsystems could use RDRAMs instead of expensive video RAM to create more pixels and colors, which require additional and faster memory. Rambus RDRAMs are three to five times faster at BitBlts (bit-block transfers) than ordinary VRAMs and could speed the arrival of affordable true-color 3-D graphics.

Some of the top DRAM manufacturers in the world, such as Toshiba, NEC, and Fujitsu, have already licensed the technology and have begun to develop RDRAM chips. Toshiba expects to ship samples of a 4.5-megabit chip in October.

Getting PC makers to incorporate the new chips is another matter. Using Rambus RDRAMs requires changes in the PC's system bus and memory interface, something PC makers won't attempt until the chips are available. The new bus, called the Rambus Channel, is a big part of what allows the chips to achieve a 500MB per second throughput. Since video can be incorporated as a subsystem, chances are we'll see graphics subsystems using the Rambus technology months before a PC maker takes the plunge.

—Christopher Barr

Better Help Through Animation

Microsoft and Lotus are the first vendors to test the water with business applications that use multimedia. But in this case the term *multimedia*, which is almost as nebulous as *object-oriented*, simply refers to animation and sound in the help system; it doesn't mean animation and sound in the application itself.

Top 15 Software Sellers at Retail

		Last Issue
1	Microsoft Dos 5.0 Upgrade Kit Microsoft Corp.	2
2	QEMM-386 6.0 Quarterdeck Office Systems	1
3	Quicken 5.0 Intuit	4
4	Stacker 2.0 Stac Electronics Inc.	3
5	ProComm Plus 2.0 Datastorm Technologies	5
6	WordPerfect 5.1 for DOS WordPerfect Corp.	7
7	Central Point Anti-Virus 1.2 Central Point	—
8	Microsoft Windows 3.0 Microsoft Corp.	8
9	The Norton AntiVirus 2.0 for Windows Symantec Corp.	6
10	The Norton Utilities 6.01 Symantec Corp.	9
11	WordPerfect for Windows Trade-Up WordPerfect Corp.	—
12	DR DOS 6.0 Digital Research Inc.	11
13	Grammatik 5 for DOS Reference Software	—
14	LapLink Pro 4.0 Traveling Software	—
15	Quattro Pro 4.0 Networkable Borland International	—

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending March 21, 1992. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market.

Sales information compiled by Ingram-Micro.

Software vendors can fit a program's entire set of paper manuals onto a 600MB CD-ROM and still have room to spare. Microsoft and Lotus have taken advantage of this enormous storage capacity to put animated help on the CD, which makes pressing F1 entertaining as well as relieving to your company's technical support desk.

Microsoft began the trend with *Multimedia Works*, a Windows version of its popular integrated program. A single compact disk contains the program files and extensive documentation files. But no software manuals come with the disk. Instead,

As the list and street prices of Hewlett-Packard's DeskJets show, ink jet printers are getting cheaper. By year's end, street prices should go as low as \$300.

		List price	Street price
1989	HP DeskJet Plus	\$995	\$700
1990	HP DeskJet 500	\$729	\$500
1991	HP DeskJet 500	\$599	\$400

Source: Hewlett-Packard.

BRIEFS

■ Apple to the Core:

Apple plans to deliver a family of Macintosh computers this fall aimed at home users. Selling in department stores for between \$1,000 and \$2,000, the consumer Macs will come with software installed and "work like hair dryers; you turn them on and they work," says Bob Puette, president of Apple USA. Personal digital assistants, such as a wallet-sized CD reader with an LCD panel, are due next year.

■ Fumbling the Future

(Not): Xerox's Palo Alto Research Center (PARC) was renowned in the 1970s for pioneering the mouse, the laser printer, the graphical user interface, and client-server networking. Now David Liddle, who spent a decade at PARC before founding Metaphor Computer Systems (sold last year to IBM, where Liddle served a brief stint), is teaming up with Paul Allen, cofounder of Microsoft and founder of Asymetrix, to launch Interval Research Corp., which will focus on developing new models of computing for both businesses and individuals.

■ History Lessons:

Until now there has been a dearth of books written about the PC industry, but 1992 seems to be making up for the last decade. *The Making of Microsoft*, a rather dry account written in French by Daniel Ichbiah and translated by Susan L. Knepper, was published last year by Prima Publishing (see Read Only, February 11, 1992). Earlier this year came *Accidental Empires*, *Infoworld's* pseudonymous gossip columnist Robert X. Cringely's scathing profile of the industry (see Read Only, March 31, 1992). In June, John Wiley & Sons will publish *Hard Drive*, a Bill Gates biography by *Seattle Post-Intelligencer* reporters James Wallace and Jim Erickson. This fall, Doubleday will publish *Gates*, by *PC Computing* contributing editor Stephen Manes and *Seattle Times* writer Paul Andrews.

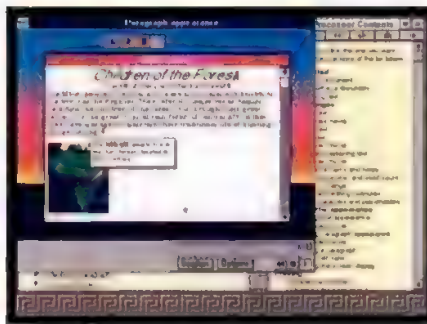
—Mary Kathleen Flynn

in what Microsoft refers to as computer-based training, a tutorial that uses sound and animation shows you the basics of the program.

When you press F1 or click on help, you're no longer presented with Windows' normal textual help files. Instead you can view help with illustrations of documents, or, from the topics list, view a "movie" of the process. It's not really a movie—there's no video or film clips—but it is an animated scene with sound that walks you through the subject.

For instance, the movie on changing a document's appearance shows you how to change the font, size, and style. It's a canned movie that doesn't actually work on your document. But you can choose "How to" from the Help Index, which lets you keep your work on the screen while another window holds the help information along with pictures of what you should do.

Lotus's first foray into multimedia applications on CD-ROM



In *Multimedia Works*, you can watch a movie or view help while you work.

manuals come in paper format.

Within Help are dozens of 2-minute Show Me movies that illustrate a topic both conceptually and procedurally. The difference between the conceptual implementation and the procedural is that a conceptual movie uses animation and sound to explain what a feature does (such as enhancing a graph and then printing and saving it), while a procedural movie guides you through the steps to create the graph. Lotus feels users will prefer the down-and-dirty procedural help for everyday use. A toggle lets you move from the canned demo to the actual spreadsheet, where you can work with live data.

Multimedia SmartHelp for 1-2-3 for Windows is expected by summer, and eventually *Notes*, *Ami Pro*, and *Freelance* will be converted to CD-ROM. Microsoft wouldn't say which applications would be updated next, but don't be surprised to see versions of *Word for Windows* or *Excel* with multimedia help by 1993.

While the animation and sound in *Multimedia Works* and *Multimedia SmartHelp for 1-2-3 for Windows* helps to ease the pain of learning and using them, questions remain: Is this the best we can do with multimedia? With multimedia in their names, shouldn't we be able to create multimedia documents and spreadsheets?

—Christopher Barr

Multimedia DSPs

CONTINUED FROM PAGE 29

for multimedia applications. The company, best known in the PC marketplace for buying Edsun Laboratories last year, believes in letting third parties—such as Digicom Systems Inc., Lernout & Hauspie Speech Productions, Spectron Microsystems, and Xing Technology Inc.—develop the operating system and "applications" (known as task libraries in DSP-speak).

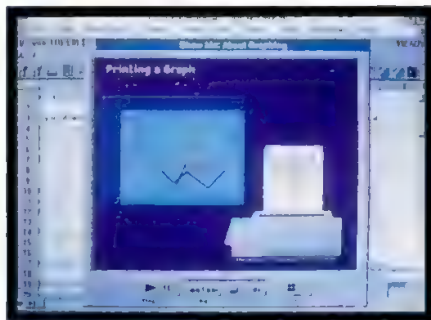
Part of the new breakthrough is that considerable effort has gone into making DSPs easier to program. AT&T, which has been using DSPs in phone systems for years, began shipping multimedia DSPs last fall, which it sells with the company's VCOX operating system. Apple and Acer are expected to deliver products based on the chips shortly.

Motorola, which makes the DSP that's built into the NeXT machine, recently rounded out its multimedia DSP family with new components: a new generation of 24-bit chips, a serial audio interface, converters, Spectron Microsystems' *Micro SPOX* operating system, and a V.32 modem with fax, voice mail, and a graphic equalizer. In addition, Motorola is now offering third-party support from Dolby, Optibase, and Turtle Beach Systems (which already uses a Motorola DSP in its sound board).

Texas Instruments, which holds nearly 60 percent of the DSP market, recently teamed up with IBM and software developer Intermetrics to deliver Mwave, a DSP subsystem optimized for multimedia applications. The subsystem consists of four components: the DSP, a library of tasks, the Mwave multitasking operating system, and a suite of application programming interfaces (APIs). IBM plans to use the subsystem in its multimedia PS/2s and add-in boards.

First-generation products based on these DSPs are likely to be boards with fax-modem, voice mail, and CD-quality sound in the \$300 to \$500 range. Will Straus, an analyst with Forward Concepts, predicts that "by 1995, all PCs will have DSPs on the motherboard."

—Mary Kathleen Flynn



Multimedia SmartHelp for 1-2-3's Show Me movies walk you through a task.

will be *Multimedia SmartHelp for 1-2-3 for Windows*. For the same price as the regular Windows version, you get the latest version of *1-2-3 for Windows*, all the user manuals, a colorful tutorial, and animated help on one CD-ROM. Tailored to reduce support calls, *Multimedia SmartHelp for 1-2-3 for Windows* begins with a 40-minute interactive tutorial called Guided Tour. None of the software

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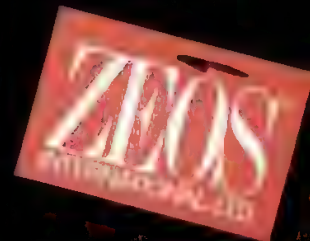
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First Looks

Excel 4.0

CONTINUED FROM PAGE 37

release the mouse button. To copy, you do the same while holding down the Ctrl key. You can clear a range by dragging a boundary inward.

Dragging cells around as though they were graphical objects may feel unnatural at first, but not for long. The program supplies good visual feedback to let you know what you're doing, prompts for confirmation if a move is about to obliterate existing data, and lets you undo any move that goes astray. You can also turn the whole drag/drop facility off if it gets in your way.

INTELLIGENT AUTOFILL

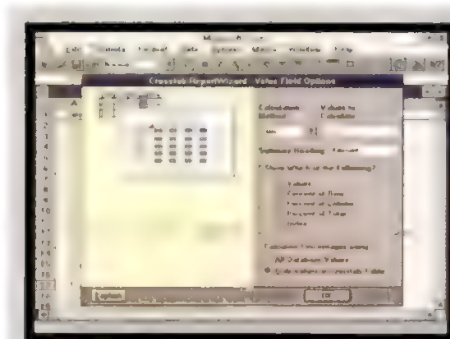
Even if you stick with the old methods, *Excel* gives you another, nearly irresistible reason for leaving the drag-and-drop feature turned on. In the lower-right corner of an active cell boundary, the program now displays a small black square called a fill handle. Drag to it and *Excel* will perform an intelligent extension of whatever is stored in the current cell or range.

For example, by typing "Jan" and then dragging the fill handle across 11 neighboring cells, you can get column labels for all 12 months of the year. Drag a cell containing the designation Q1 (or Qtr 1, Quarter 1, or even 1st Quarter), and you get quarterly labels. Extend the fill handle from a pair of cells containing any two numbers, and *Excel* creates an arithmetic series.

ANALYTIC POWER BOOST

A handful of supplied add-ins give *Excel* 4.0 a major boost in analytic power. The most important of these are called the Analysis Toolpak and the Crosstab ReportWizard.

The Analysis Toolpak is a set of new commands and functions. Among other things, the new commands let you generate random numbers that meet various nonuniform distributions, generate frequency tables and histograms, produce rank-and-percentile tables, generate moving averages (with and without ex-



Excel's Crosstab ReportWizard makes it easy to analyze database records.

ponential smoothing), extract random and periodic samples from a data set, generate a table of descriptive statistics, and perform a variety of standard statistical tests. In keeping with the overall thrust of this upgrade, *Excel* 4.0's new calendar functions are designed to simplify tasks that are awkward to perform with traditional spreadsheet methods.

The new financial functions include both widely applicable items (for example, FVSCHEДУLE, which calculates the future value of an investment given a schedule of changing yields) and specialist tools (for example, MDURATION, which returns the Macauley modified duration for a security with an assumed par value of \$100).

The engineering category includes unit-converting functions and functions for performing imaginary- and complex-number arithmetic. Other new functions let you round numbers to multiples other than 1, calculate least common multiples and greatest common divisors, find the integer portion of a division, and more.

The Crosstab ReportWizard takes all the grunt work out of cross-tabulating *Excel* databases. With this add-in you can, for example, take a database of financial transactions and quickly turn it into a table organized by expense category and subcategory in the row dimension and time periods in the column dimension. You can add subtotals in either dimension and aggregate the data with any of the standard statistical functions—SUM, AVERAGE, or whatever. *Excel* automatically outlines the resulting table, so you can easily pop in and out of any level of detail.

To top it all off, if you want to see the individual records behind any aggregate value, all you need to do is double-click on the aggregate cell; *Excel* goes back to the database, does a quick extract, and presents each relevant record in a new table.

Other analytical improvements include a Scenario Manager and a revised Solver. The Scenario Manager lets you assign names to alternative combinations of variables, and will optionally create a table showing the impact of each scenario on any set of outcome cells. The Solver, rewritten in C, is faster than its predecessor and now accepts integer constraints.

DEALING WITH LOTUS MACROS

Excel 4.0 lowers the principal barrier to migration from 1-2-3 by including a 1-2-3 macro interpreter. Most macros written for 1-2-3, Release 2.x, will run correctly on import into *Excel*. Macro verbs introduced with Release 3.0 are not supported, and a few Lotus commands (particularly those involving add-ins) will fail because *Excel* offers nothing equivalent. But the macro interpreter makes it possible for some users to move to *Excel* who simply couldn't consider it before because of the expense of converting macros.

On the presentation front, the most welcome improvement is print scaling for any printer driver (*Excel* 3.0 offered this only for PostScript printers). You can specify either a scaling percentage or the number of pages you wish to fill (for example, two pages deep by three pages wide).

Other enhancements include a slide-show facility (complete with visual and sound transitions but no ad-hoc branching), a Report

Manager add-in, an automatic formatting feature, a spell-checker, and import/export support for the Lotus .FMT and .FM3 formats. The AutoFormat command assigns canned sets of formatting attributes to worksheet regions based on the program's analysis of your data structure.

The .FMT/.FM3 support is not perfect (WYSIWYG attributes coded into worksheet data are not translated, for example), but it's good enough to make most *Excel* worksheets presentable in 1-2-3 and vice versa.

There's more: A workbook facility that brings *Excel* a notch closer to true three-dimensionality (functions can take arguments that span worksheets, but names can still be defined only within particular sheets), some new 3-D chart types, the ability to change a chart's 3-D perspective by dragging with the mouse, and a Chart Wizard that simplifies graph creation and customization.

There are warts, too. The new MODE function mishandles data with tied mode values. Some of the add-ins should have been merged so you wouldn't have to wonder about which functions are in which module. The Scenario Manager could have been a lot stronger and should have been integrated into the core product.

Taken as a whole, though, *Excel* 4.0 is a colossal upgrade—a dramatic improvement to a product that was already well ahead of the pack. ■



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List Price: \$495

Requires: 2MB RAM (4MB recommended), 5MB hard disk space (10MB recommended), Microsoft Windows 3.0 or later.

In Short: Microsoft has improved *Excel* dramatically in three principal ways: by adding a wealth of analytic features, by making everyday spreadsheet tasks easier to perform, and by enabling users to import 1-2-3 files, all complete with macros and WYSIWYG formatting.

CIRCLE 428 ON READER SERVICE CARD

First Looks

Painter

CONTINUED FROM PAGE 37
or increase ink opacity.

On a more advanced level, you can customize brushes using the Methods option or several ancillary palettes that control brush size, brush behavior, and brush expression. For example, using the Expression palette you can choose to have a brush stroke change in response to pressure (if you are using a pressure-sensitive digitizing tablet) or to velocity (with a mouse).

The presence of these controls makes it possible to create unique and even fantastic brushes. For example, *Painter* ships with two special brushes that can mimic the painting styles of van Gogh and Seurat.

Painter's sophisticated tech-



FACT FILE

Fractal Design Painter for Windows, Version 1.2

Fractal Design Corp., 334 Spreckels Dr., Suite F, Aptos, CA 95001; 408-688-8800.
List Price: \$399.

Requires: 386-based PC or better, 6MB RAM, Microsoft Windows 3.0 or later, Super VGA monitor. A 16- or 24-bit graphics adapter and a pressure-sensitive digitizing tablet are recommended.

In Short: A low price of \$399 belies the sophistication that allows *Fractal Design Painter* to simulate brush strokes in any traditional media—oils, watercolors, airbrush, or colored pencils.

CIRCLE 426 ON READER SERVICE CARD

EXPANDING PAINTER WITH PLUG-INS

Fractal Design Painter offers many innovations to computer artists, including support for Aldus's recently announced Plug-In technology for Windows. The only other program that offers this feature is Aldus's *PhotoStyler*.

Although Plug-In programs were first introduced on the Mac, the technology is based entirely on Windows capabilities. A Plug-In is a DLL

(dynamic link library) that allows a host application, such as *Painter*, to integrate wholly the functions of a Plug-In program, such as the \$199 *Gallery Effects* from Silicon Beach Software. Once installed, *Gallery Effects* functions as a part of *Painter*, augmenting its functionality.

We tested a pre-release copy of *Gallery Effects* with *Painter* and found the inte-

gration to be seamless. Installing the Plug-In filters is as easy as copying the directory containing the effects into *Painter's* directory.

Gallery Effects lets you define an area using *Painter's* marquee selection tool; choose one of 16 different filters such as Emboss, Ripple, or Mosaic; and determine the level of the effect using slider bars.—LS

nology is most apparent in its Cloning feature. Cloning allows you to reproduce an existing image in a completely different artistic style. Therefore, it's possible to make a scanned-in photograph look like an airbrushed painting (or perhaps a van Gogh canvas or a charcoal sketch).

The cloned copy is revealed with each brush stroke you paint in the designated style you've chosen. In order to achieve these wonderful effects you must draw each brush stroke manually. The automatic cloning command saves you some work, but it doesn't replace the artist's hand (or in this case, mouse).

If you want to apply a special effect to an entire image, you have fewer options. You can use *Painter's* internal commands to adjust the brightness and contrast of a picture, or to give an overall texture to a painting. You can also augment *Painter's* capabilities by adding special-effect filters from Silicon Beach Software's *Gallery Effects* program (see the sidebar "Expand-

ing Painter with Plug-Ins").

Painter is a highly innovative program, but it isn't perfect. The program offers only a square selection marquee. That means you can only cut and paste rectangular portions of your picture. There is no text tool, and you cannot draw simple geometric shapes like circles or lines.

Painter does come with a set of friskets (or masks) that allow you to protect portions of the image as you are painting. You can resize or rotate friskets, and even draw your own freehand shapes. However, the program does not enable you to create friskets with straight edges or edit the shape of a frisket.

Painter can read and write several different 24-bit graphics file formats, including .BMP, .PCX, Targa, TIFF, and bit-mapped PICT. Fractal Design's native .RIF format is also compatible with the Macintosh version of the product. The information must be stored as true RGB values—no indexed palettes or CMYK colors are

allowed—so *Painter* can't generate four-color separations. And if you print from *Painter* directly you must use a printer that interprets color .DIB (Device Independent Bitmaps) files.

Although *Painter* requires 6MB of RAM, there are instances in which performance is unacceptable. The watercolor brush, which makes the program juggle information about the painting surface, the water surface, and the brush itself, is notably slow.

Of course, you can improve performance by adding more memory. In addition, our testing revealed Windows 3.1 to be a much more robust environment for *Painter*. If you insist on using *Painter* with Windows 3.0, be prepared to edit your system configuration.

Despite the program's limitations and high-end hardware requirements, *Fractal Design Painter* breaks new ground for computer-based art. It creates expressive, painterly images that will satisfy even the most demanding artist. ■



This image takes advantage of two different *Gallery Effects*: Poster Edges and Color Balance.



Painter can clone an image in a number of different ways. Here, an unusual paper texture was applied.



Notice the soft feathered edges at the bottom of the image that mimic an airbrush pattern.

Teleform: Fax Data Straight Into Applications

HANDS ON
by John R. Quain

At \$995 for a single-user version, Cardiff Software's *Teleform* has a big price tag to match its big ambitions. Designed to leverage the ubiquity of fax machines and the database gathering potential of electronic forms, *Teleform* builds on previous software to create a program that is part fax board interface, part forms maker, and part character recognition device.

By creating forms that can be filled in, faxed back, and automatically retrieved by nearly any Windows application, *Teleform* can be used for a wide array of business applications. Users can send one standardized form to multiple fax machines to conduct customer satisfaction surveys, solicit sales information from regional offices, and get time-sensitive forms filled out and entered into a database or spreadsheet quickly. (You'll need a 486-based PC with a fast hard disk for it to work well.) *Teleform* can even generate mailing labels from the faxed-in responses.

Each form bears an identification code in the top left-hand corner, as well as alignment blocks at the bottom and top of the page. The ID code lets the program match incoming forms to an original template, which is then used to interpret the handwritten answers. Because of its object-based templates, *Teleform* can't import forms created in other packages.

FAX BOARD CONTROL

The fax board driver portion of *Teleform* is based on Alien Computing's *FAXit* software, which supports over 40 different fax boards. Cardiff, however, guarantees compatibility only with Intel, Complete PC, and Megahertz fax boards. You can use boards from other manufacturers, but installation can be a tricky affair.

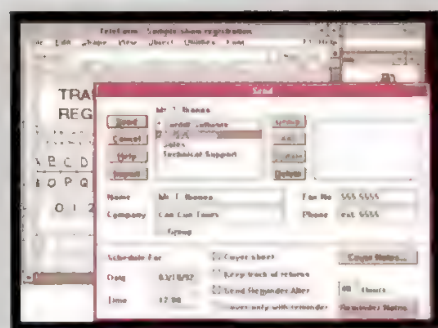
Teleform doesn't include the

full version of *FAXit* so you'll occasionally run into dead end dialog boxes, even though the previous screen may have offered the option of moving ahead. Otherwise, *Teleform* is capable of doing just about everything you'd expect from regular fax software.

Sending options include queuing a series of numbers for immediate or delayed transmission. A phone book imports ASCII text and can be divided up into groups. This allows you to spec-

including Modern and Helvetica faces in bold, italic, and underline. Fixed point sizes range from 6 to 72 points. Unfortunately, *Teleform*'s display has some minor WYSIWYG glitches. When printed out, type will sometimes overwrite a defined box even though it appears fine on-screen. Cardiff recommends using *Adobe Type Manager* to remedy the problem.

Creating the actual areas to be filled in on the form is a snap. There are a half-dozen sample forms, and a "glossary" of about 30 commonly used graphics elements, such as boxes for address labels, is available. You can define your own fields and select a range of values (letters or numbers) for the template to use when interpreting responses.



Teleform's send fax menu includes options to keep track of return faxes and to send reminders at a specified later time.

ify one group with the click of a button.

Teleform will also accept standard faxes from any Group III fax machine. The program gives you the option of storing the file to disk or printing it out. If you opt to store faxes on disk, the program stores them as .PCX files. At 200K or more per page, this can quickly fill up your hard disk.

DESIGNING FORMS

The forms-designer portion of *Teleform* keeps the documents simple so that forms don't become too complicated for low-resolution fax machines. The program includes line, rectangle, and ellipse drawing primitives. There are nine fill options, but most are a basic crosshatch pattern. Lines can be set as solids or dashes and in various widths. Monochrome bitmapped art also can be imported from any Windows-compatible program through the Clipboard.

There are six font options,

HANDWRITING RECOGNITION

As incoming faxes are received, *Teleform*'s Manager either runs the interpreter immediately or stores the faxes as .PCX files. Using handwriting recognition software from Nestor, data from correct forms can be automatically sent to a database, spreadsheet, or ASCII file. *Teleform* supports .CSV, .DBF, .DEL, .DIF, .DBF, .WK?, .XLS, and Paradox formats. DDE (dynamic data exchange) support means forms also can be received and information updated using hot links.

There are strict limitations on what kind of handwritten data *Teleform* will accept, however. It's able to recognize uppercase letters, numbers, and filled-in bubbles. Constrained letter boxes generally work well, but if a letter touches the side of a box or the transmission is muddy, it can easily be misinterpreted. Respondents also have to remember not to put slashes through zeros and to fill bubbles in completely; check

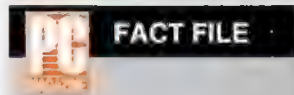
marks won't do.

In order to arbitrate this process, *Teleform* can be assigned a confidence level to use when receiving completed forms. The default is 65 percent. If you raise the percentage, the program's reading accuracy goes up—but so does the number of forms *Teleform* stores for manual correction. Bring the confidence level down too low, and some incorrect letters and numbers are bound to slip through.

In testing, raising the confidence level to 85 percent resulted in a couple of misses. When these are detected, the guilty form drops into a directory for later correction. When called up, the problem area of the form is displayed in bitmapped .PCX fashion, and above it the interpreted characters with question marks.

If someone decides to return a completed form the old-fashioned way—through the mail—*Teleform* can read it using an HP ScanJet or ScanJet Plus. But not all of the program's elements are as friendly as they could be. The phone book utility, for example, doesn't have an option to exit or close (choosing OK works). Users can't resize dialog boxes, though the boxes can be moved aside.

Considering the tasks *Teleform* sets out to accomplish, however, the glitches we discovered look insignificant. This is a very promising area of business software. Given its potential, both large and small businesses should take a close look.



Teleform, Version 1.0
Cardiff Software Inc., 531 Stevens Ave., Bldg. B, Solana Beach, CA 92075; 800-659-8755, 619-259-6444.
List Price: \$995.
Requires: 4MB RAM, Microsoft Windows 3.0 or later, Group III fax board.
In Short: *Teleform* is a ground breaking package. The first of what will surely be many fax/form/database products, it has a couple of rough edges and some inconvenient restrictions, but it fills a need and it fills it well.

CIRCLE 429 ON READER SERVICE CARD

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CIRCLE 28 ON READER SERVICE CARD

Microsoft Keeps Up the Pace in SQL Server Race



Microsoft's OS/2-based *Microsoft SQL Server* (co-written with Sybase) has been the top-selling PC-based database server since its release three years ago. Over time, other SQL database vendors have added improvements to their products that put them on a par with or even ahead of

UNIX versions; it also indicates that both versions now have the same features. One of the biggest enhancements over the prior version is the ability to split (segment) a database across multiple drives or partitions; like Gupta's *SQLBase 5.0* (First Looks, March 31, 1992), database size is limited only by disk space.

Microsoft has also added significant features to protect

the server down. Dynamic backup is available through the *Systos Plus* tape backup utility, which is bundled with *Microsoft LAN Manager* or available separately.

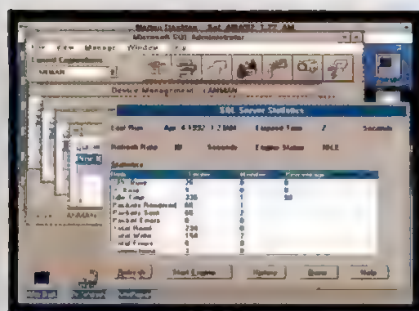
Data integrity has also been enhanced through the addition of true referential integrity, which prevents records in one table from deletion when they're dependent on records in another table.

BETTER ADMINISTRATION

Database administration has been enhanced by the addition of a Windows 3.x-based system administration facility that includes a real-time database monitor. It also supports administering local and remote servers and database backups.

The package also includes a server-adapted version of OS/2 1.3. A *LAN Manager* network isn't needed to run the database server; it will work with any network that supports Named Pipes, such as Novell's *NetWare*, Banyan's *VINES*, and IBM's *LAN Server*. It also runs under any OS/2 1.21 or 2.0 system, though unlike Sybase's UNIX or VMS versions, the code is still 16-bit and doesn't gain much from running under 32-bit OS/2 2.0.

Microsoft has announced that *SQL Server* will be moved to a 32-bit platform with the release of the Windows NT version sometime in the next year or so. Sybase has announced an NLM version that will debut later this year.



Microsoft's *SQL Server 4.2* includes the graphical *SQL Administrator* for Windows and OS/2. One of its many features is this real-time server resource monitor.

Microsoft's system. With the release of *SQL Server*, Version 4.2, Microsoft has solved some problems and added a number of new features to increase database size and integrity.

The new version is numbered 4.2 to bring Microsoft's numbering scheme in line with Sybase's

database integrity. Chief among these is the addition of fault tolerance, through the ability to mirror the database or transaction log (or both) to a different disk automatically. *SQL Server 4.2* can also back up to tape dynamically even while users are accessing it, without having to shut

WHY USE A SQL DATABASE SERVER?

SQL database servers have characteristics that make them attractive alternatives to the standard PC-based multiuser databases we reviewed in "Nine Multiuser Databases: Robust and Ready to Share," March 31, 1992:

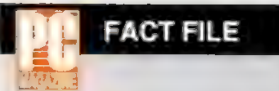
1) Standards: SQL is a standard language for database access. There are two ANSI specifications in place, and you can get database systems that use SQL from numerous vendors, making it easier to create cross-platform applications.

2) Performance: SQL servers are the basis of client/server systems. By splitting processing between server and workstation, the performance of the application is no longer solely dependent on the workstation. You can process large amounts of data without investing in hardware upgrades for PCs.

3) Flexibility: With a standard multiuser database, every user has the same application interface. With a SQL server, any number of front ends can be used to access the data.

There are also a number of gateway products that link SQL databases from different vendors and platforms.

4) Data Integrity: Most PC-based SQL servers are based on the Relational Database Model, which focuses on data integrity. Its methods are transaction processing, where changes to the database can be "rolled back" if there are any problems; automatic recovery after system crashes; and fault tolerance using disk mirroring or real-time tape backups.—JS



SQL Server, Version 4.2
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400.
List Price: 10-user version, \$2,995; unlimited version, \$7,995; Developer's System (single user), \$1,495; upgrade from 10-user to unlimited, \$5,495. Upgrade from 1.x versions: \$595 for 10 users; \$1,595 for unlimited users.
Requires: 8MB RAM, 20MB of hard disk space; OS/2 1.21 or later (1.3 included in package); network that supports Named Pipes.
In Short: Microsoft's *SQL Server 4.2* jumps out in front of its competitors with increased data reliability, enhanced administration and programming tools, and scalability with a number of databases on larger systems. It's a serious contender for platform-of-choice in the client/server arena.

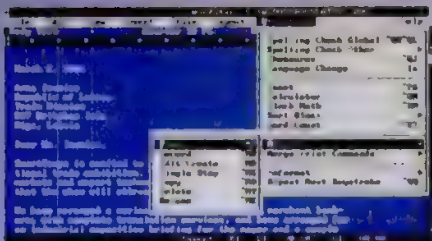
CIRCLE 430 ON READER SERVICE CARD

NEW DEVELOPER'S SYSTEM

Microsoft has released a single-user Developer's System (\$1,495) to encourage VARs and database consultants to design *SQL Server*-based apps. Also, a number of programming toolkits have been released for C, COBOL, and Visual Basic (\$495 each).

In addition, Microsoft has joined with SQL Solutions Inc. to provide a somewhat expensive two-part gateway between Microsoft/Sybase *SQL Servers* and Oracle, Ingres, Informix or VAX RMS databases running on a minicomputer. The *Gateway Link* software runs on a PC under OS/2 1.1 or later and lists for \$3,000. The minicomputer-based *Gateway Services* software ranges in price from \$15,640 to \$100,000.

By providing full platform scalability with Sybase's servers (and others through gateways), sophisticated fault tolerance, and a variety of development toolkits, Microsoft has again brought *SQL Server* to the forefront among PC-based SQL servers. Organizations looking to integrate LAN-based databases with preexisting large systems or to downsize to a LAN should give serious consideration to *SQL Server 4.2*. It finally has the power and features to handle the task. ■



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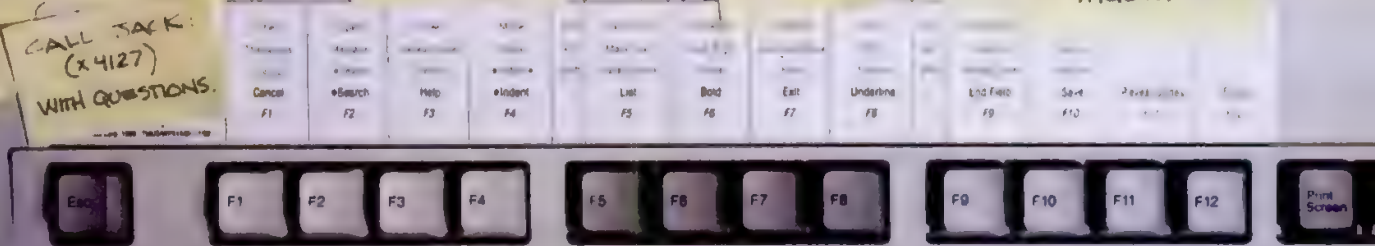
WHAT DOES
BLINKING
P.O.S. MEAN?

CALL JACK:
(x4127)
WITH QUESTIONS.

Doc 2 empty,
Shift F3
THEN F7

NOT TELL FR.

Not enough
memory for
index.



Arago Gives Xbase Developers Hot Compiler, Interface Tools

HANDS ON
by Richard Hale Shaw

Only rarely do Xbase developers sit up and take notice of a new product. Last year, it was Fox Software's *FoxPro* 2.0. This year, so far, it's the arrival of WordTech Systems' *Arago Professional*, Version 2.0. Despite the version number, this is the first release. (We review five other Xbase products in "Xbase Development Systems: Alive and Better than Ever" in this issue.)

TWO-PART PACKAGE

Compatible with both *dBASE III Plus* and *dBASE IV*, the \$1,199 *Arago Professional* includes both *Arago Quicksilver*, a native-code .EXE compiler, and an interactive CUA-compliant front end, *dBXL*, both of which can be purchased separately. The latter consists of several components, including *INTRO*, an end-user module for creating and manipulating databases; a *PanelPainter* that simplifies interface design via object-oriented technology; and a facility for generating

business graphics from database files. *Arago* also has enhanced memo fields, a number of useful development tools, and a C interface that rivals that of Nantucket Corp.'s *Clipper*.

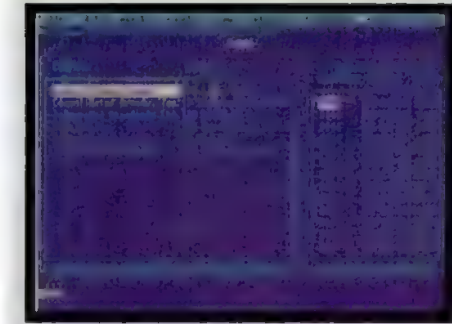
If you're familiar with *FoxPro*'s interface, you'll recognize the CUA-compliant aspects of *Arago*. While you can always use the dot prompt, *Arago*'s *INTRO* offers pull-down menus, buttons, and list boxes for selecting actions, databases, and fields.

The interface is, at times, anemic: The windows are not movable, sizable, or easy to see, and sometimes there's no way to use the mouse at all. It lacks a dot-prompt window like *FoxPro*'s, and the interface is not as quick to respond as it is in competing products. It's not that *dBXL* isn't easy to use—it is—but comparatively speaking, it's not nearly as easy as it could be.

Nevertheless, *INTRO* makes short work of mundane, everyday database operations such as open, browse, edit, append, delete, and import/export. Some operations are even simpler to do than in *FoxPro*.

For example, all you have to do to relate two tables with *dBXL* is open the tables and select a relation field. In seconds you have a two-table browser/editor while maintaining a one-to-many relationship between the tables. No coding, just a few mouse clicks. Not bad.

Even more impressive is the *Arago PanelPainter*. A panel is a *dBXL* object, an event-driven, CUA-compliant window that's composed of push buttons, list boxes, and fields. Panels have built-in behaviors and attributes that can be used as-is, or overridden if need be. You simply select and position the objects you want and *Arago* will generate the Xbase code for them. All the objects automatically repaint themselves when needed and all



Arago's *INTRO* makes it a snap to display browsers on two database files and link them in a one-to-many relationship.

offer built-in mouse support. Since the objects in *PanelPainter* are live, you can test them as you create them.

If you're new to this kind of interface design tool, the Quick Layout option lets you select the database fields to use and create a simple form that you either use as-is or modify. Quick Layout automatically turns logical fields into check boxes, provides a look-up list box for State fields, and adds validation checks on phone and ZIP code fields.

Once you've completed a panel, you can generate the Xbase code by selecting it from a menu item. There are options for controlling how the source code is generated and formatted and how variables are declared. There's also considerable flexibility in what code is executed by what objects, and you can specify the scope of memory variables and keyboard shortcuts and prompts. Once you're done, you can run the program as-is or easily compile it to an .EXE file with *Quicksilver*.

While *PanelPainter* is incredibly powerful, it's often awkward and unintuitive. The mouse interface has gaps, and a toolbar would be better for selecting new objects. Resizing and moving an object can drive you crazy, and overall, *PanelPainter* is sluggish.

C INTERFACE

Arago's C interface is modeled after *Clipper*'s: You can call C or assembler routines from your Xbase code or have them call back into *Arago* via an API. You have the choice between the Microsoft or Borland C compilers (with *FoxPro*, you must use the Watcom compilers), and you can even call C functions from the interactive environment.

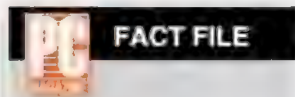
The *Quicksilver* compiler is

fairly easy to use and, considering the size of most Xbase compiled code (*FoxPro* programs are at least 640K and can easily run over 1MB), relatively small. A simple program we created was 272K, and a standalone version of the two-table browser we built compiled and linked to 613K. Other features for developers include PocketSoft's *OptLink*, up to 32-character identifiers, an application generator, a coverage analysis-based source profiler, and Concentric Data's *R&R Relational Report Writer*.

Arago lets you create six different types of graphs from a database, and create graph forms—templates that change as the database does. You can send them to the screen or printer, save them as .PCX files, or store them in an *Arago* memo field. *Arago* memo fields can contain any kind of binary data, and you can use a memo field in place of a character string. Memo fields can have an unlimited size.

Arago isn't as fast as *FoxPro* on all counts, but it comes close. Both *dBXL* .PRGs and *Quicksilver* .EXEs take about 50 percent longer to build an index data file, 15 percent longer to perform an unconditional search-and-replace, and 70 percent longer to execute a conditional search-and-replace. Considering that these differences are a matter of seconds on a 50,000-record file, you won't be unhappy with *Arago*'s performance.

For developers, the combination of object-oriented technology, a powerful interface designer, and a true .EXE compiler make *Arago* an unbeatable combination. That's not to say it can't use some fine-tuning, especially in the user interface, but if you take a long look at *Arago*, you'll like what you see. ■



Arago Professional, Version 2.0

WordTech Systems, 21 Altamira Rd., Orinda, CA 94563, 510-254-0900.

List Price: *Arago Professional*, Version 2.0, \$1,199; *Arago Quicksilver* compiler, \$799; upgrade, \$199; *Arago dBXL*, \$699; upgrade, \$159.

Requires: 640K RAM (2MB recommended), 10MB hard disk space, DOS 3.1 or later.

In Short: *Arago* is a professional Xbase development system with a powerful screen painter and a sophisticated C-language interface. It includes *R&R Report Writer*, graphics facilities, and a simple profiler.

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position. Reply options open at

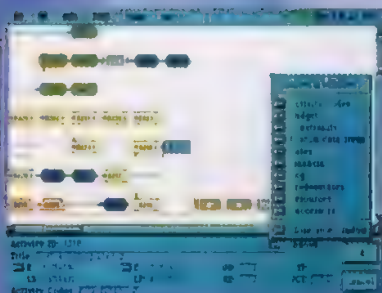
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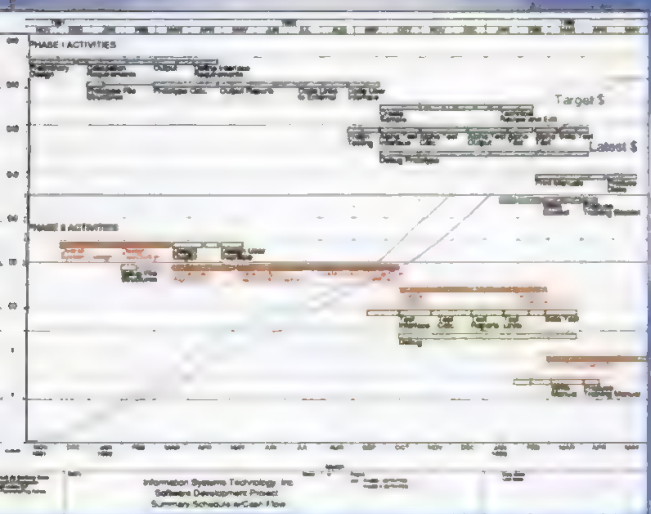
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First Looks

HP's \$1,295 ScanJet IIp Sets New Scanner Standard

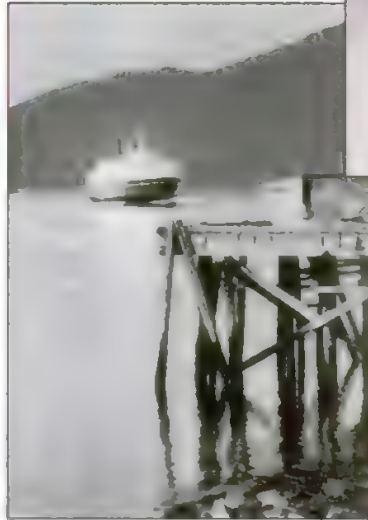
HANDS ON
by Matt Jones

Don't let appearances fool you. The 300-dot-per-inch Hewlett-Packard ScanJet IIp gray-scale scanner may look cute as a button—if only for its sleek, downsized chassis—but its blazing speed and superior scan quality will please the most demanding of users. Its ground-breaking \$1,295 list price (\$1,095 for the Macintosh), ease of use, and ability to integrate with TWAIN-compliant applications should prove tempting.

Measuring just 3.2 by 11.4 by 16 inches (HWD), the ScanJet IIp perches unobtrusively atop a desk or credenza. The sole price you pay for the tidiness of the package concerns the size of the scan bed itself: The ScanJet IIp accommodates paper no larger than 8.5 by 11.7 inches. The 20-page automatic document feeder, which lists for \$395, accepts pages as small as 7.2 by 10.1 inches and as large as 8.5 by 14 inches, but the scanner still can access only 11.7 inches of the length of a page.

As with other recent ScanJet offerings, HP has automated the installation process to an impressive degree. A software installation routine automatically installs the included Windows applications, HP's *DeskScan II* and Z-Soft's *PhotoFinish*, along with their Windows icons.

The IIp's much larger, color-capable sibling, the \$2,195 HP ScanJet IIc, hummed and whirled its way to an Editors' Choice in our recent color scanner roundup ("True-Color Performance at Gray-Scale Prices: Nine Desktop Scanners That Do It All," April 14, 1992), partly for its superior overall speed and excellent image quality. Notably, the IIp matched or surpassed the image quality of the IIc on 150- and 300-dpi scans, turning in what is perhaps the best gray-scale output we've seen. It also performed faster across the board.

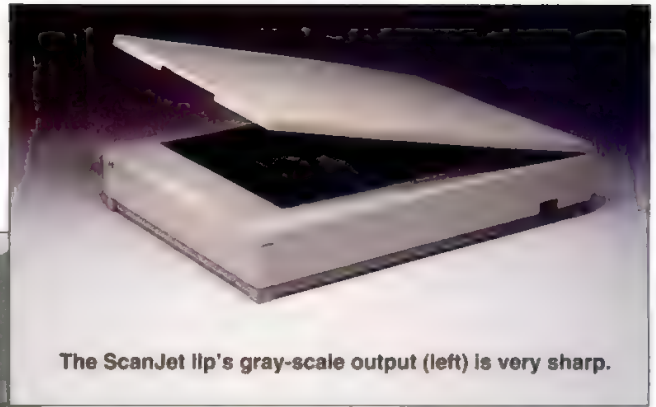


Controlled by HP's *DeskScan II* software, for instance, the ScanJet IIp scanned our sample text page at 300 dpi in 15 seconds and completed our 300-dpi gray-scale sample in 31 seconds when set to its 8-bit, 256-gray-scale mode; the IIc required 22 and 40 seconds, respectively, for the same tasks when driven by a somewhat slower 386 machine running at the same 25 MHz. Running on identical machines and driven by *ExperVision's TypeReader*, the IIp scanned the text page in 23 seconds, while the IIc required 27.

The 300-dpi ScanJet IIp scans images in 1-bit (line-art), 4-bit (16 gray-scale levels), and 8-bit (256 gray-scale levels) modes. Interpolation boosts logical resolution to as high as 600 dpi using pixel averaging and 1500 using pixel duplication. Like the ScanJet IIc, the IIp also incorporates Hewlett-Packard's *AccuPage* technology, which provides OCR vendors with a method to increase recognition accuracy considerably on pages with shaded or colored backgrounds. The IIp is compatible with the HP ScanJet Plus drivers.

TWAIN MAKES IT EASIER

Numerous vendors are working at least somewhat in concert to



The ScanJet IIp's gray-scale output (left) is very sharp.

introduce mainstream users into the world of image acquisition and editing, largely by making the process easier and less intimidating, and Hewlett-Packard is playing a leading role in that effort. The initial results of this can be seen in the software supplied with the IIp, partly in its early support for the TWAIN application program interface (see *Trends*, March 17, 1992).

To capture any image, for instance, you can take either of two approaches: You can switch to *DeskScan II* and scan the image in the traditional manner or, taking advantage of the TWAIN support, invoke the scan from within Z-Soft's *PhotoFinish*. Once you've clicked on "Acquire" from within *PhotoFinish's* File menu, *DeskScan II* pops up, automatically conducts the preview scan for you, makes a guess at the appropriate scan mode by analyzing the image, and sets the image exposure.

Once the scan is completed, *DeskScan II* unloads itself and the image is ready for editing within *PhotoFinish*.

ScanJet IIp buyers who are more concerned with bringing recognized text directly into their applications have the option of purchasing another TWAIN-compliant product, Caere Corp.'s \$595 *OmniPage Direct* OCR package, at a discounted price of \$300 through September 1992 (see *First Looks*, this issue). Purchasers of the IIp during this time will also be eligible to receive a free TryPack for *OmniPage* that provides the package's full capabilities for 25 scans.

With *DeskScan II* itself, HP also provides numerous welcome

(if not so glamorous) features. These include an automatic exposure button, which allows automatic adjustment of contrast and brightness; a live preview, which shows the results of adjustments and changes in scan settings on the preview image as you make them; and a collection of tools for fine-tuning scans.

PhotoFinish, a 24-bit image-editing package that retails separately for \$199, omits a few features graphics sophisticates might miss, such as color separation and customizable filters, but it provides more than enough functionality to keep most buyers busy (see *First Looks*, February 11, 1992).

Simply put, the HP ScanJet IIp rates as the best buy going in desktop scanners today, both for its bargain pricing and top-rate performance. For most general office applications, this scanner should provide the right mix of features, and assuming it carries the 30- to 40-percent discounts typical for HP products, do so at a mercifully low price. ■

**FACT FILE**

HP ScanJet IIp
Hewlett-Packard Co., 19310
Pruneridge Ave., Cupertino,
CA 95014; 800-752-0900
List Price: \$1,295, with ISA or
Micro Channel interface.
Requires: 2MB RAM, 4MB
hard disk space, Microsoft
Windows 3.0 or later.
In Short: The 300-dpi HP
ScanJet IIp combines a space-
saving design, field-leading
performance, ease of use, and
bargain pricing, making it the
best value going in flatbed
scanning to date.

CIRCLE 421 ON READER SERVICE CARD

OmniPage Direct: OCR Seamlessly Integrated Into Windows Applications



With the introduction of its \$595 *OmniPage Direct*, Caere Corp. has taken a healthy stride toward revolutionizing the way the typical office inputs documents. This latest OCR (optical character recognition) wonder matches the excellent recognition accuracy of the company's venerable *OmniPage* (\$695) and *OmniPage Professional* (\$995) programs, but features one capability that sets it well apart from the pack: By automatically adding a link to itself from each of your applicable Windows applications, the package allows text to be scanned and recognized from within any of those applications. The recognized text flows directly into the application, ready for editing, printing, or whatever else you might have in mind.

Caere's \$595 *Typist* hand scanner and OCR package also dumps recognized type directly into applications, and unlike *OmniPage Direct*, *Typist* also works with DOS applications. *Typist* remains a good and versatile low-budget solution, but page scanners have many advantages over hand scanners. They're far easier and quicker to use, provide higher accuracy, and allow

the use of automatic document feeders to speed things up when you're working with multiple-page documents.

AUTOMATIC SETUP

OmniPage Direct's automatic setup routine adds a Scan Text menu item to most of the applications the program will support. The few exceptions are *Ami Pro*, *Microsoft Excel*, *Microsoft Word for Windows*, and *WordPerfect for Windows*, which require that you run a quick macro provided for each. *Direct* was designed to work with programs that deal primarily with text and numeric data and does not work with drawing or image-editing applications.

Once you've installed the program, you'll find the Scan Text menu item in the File or Control menu of each application (as long as *Direct* has already been launched).

As a default, the code necessary for actual character recognition will only load once you initiate a scan, and you'll probably want to leave it this way. This portion of the package will occupy nearly 3MB of system memory (RAM plus swap-file storage) when fully loaded, and a good bit more when actually recognizing text.

When it comes to the actual scan and recognition process, *OmniPage Direct* looks and works in much the same way as traditional *OmniPage* packages. Once you've clicked on the Scan Text button, the Scan Settings dialog box appears over your application. This dialog box gives you a chance to specify numerous options, such as the size and orientation of the page and whether or not you want automatic page recognition, multiple-page scanning, automatic intensity adjustment, and hard returns at the end of each line.

One of the several departures from the other *OmniPage* prod-

ucts becomes apparent as you first browse through recognized text in any given application: As with *Expervision's TypeReader*, *Direct* attempts (with fairly good results) to retain the type style, type size, and margins of the original document by inserting the appropriate codes into the given application. Unfortunately, as with *TypeReader*, the program can't turn off this feature.

Other shortcomings of *Direct* for some applications include its inability to recognize text from prescanned files, to save scanned text for deferred processing, and to save graphics. Some users may also regret the lack of proofing tools, such as a spell-checker, and the inability to limit the contents of a zone to numeric or alphabetic characters.

When it comes to speed, *Direct* can't compete with its traditional *OmniPage* counter-

For recognition of text smaller than 8 points and for 9-pin dot-matrix output you'll get more accuracy elsewhere, but *Direct* will do a better job with well-formed characters of the most common type sizes than any of its competitors.

ACCUPAGE TECHNOLOGY

Caere's temporarily exclusive support of Hewlett-Packard's *AccuPage* technology, when used with either the HP ScanJet IIc or ScanJet IIp (see page 46 this issue), also gives *Direct* an edge over the competition, at least for the time being. *AccuPage* drastically boosts recognition accuracy on pages with colored or shaded backgrounds. It also includes routines that aid the software in interpreting document structure.

To provide similar capabilities (minus the document structure routines) with scanners from



OmniPage Direct does a good job of optical character recognition, no matter what the type styles or layout of the scanned document look like.

parts, but it keeps up with or surpasses most other packages, even with its increased overhead. During testing on a 25-MHz 386 machine driving an HP ScanJet IIp scanner, we clocked the entire process, from the beginning of the scan to editable text within Windows Notepad, at an average of about 75 seconds for a single-column page. *TypeReader* averaged several seconds longer, while *OmniPage Professional*, running on an identical machine but driving the somewhat slower ScanJet IIc, completed the same chore in about 50 seconds.

Given that *OmniPage Direct* uses the same omnifont recognition engine that has put the other *OmniPage* offerings at the top of their class, it comes as no surprise that this latest offering has no need to apologize when it comes to recognition accuracy.

other manufacturers, Caere equipped *Direct* with its own AnyPage technology. *Direct* supports scanners manufactured only by Hewlett-Packard and Microtek for now. A company spokesperson reports that support for other scanners will be added in June.

With its lack of support for a few high-end features such as deferred processing, *OmniPage Direct* can't compete with full-featured packages such as *OmniPage Professional* for use in high-volume applications. On the other hand, this package offers all of the features most general-office users will demand, in a way that makes manual data entry seem needlessly unproductive and mundane. Despite its few shortcomings, this package provides the best reason yet to give character recognition a try. ■



FACT FILE

OmniPage Direct

Caere Corp., 100 Cooper Ct.,
Los Gatos, CA 95030; 800-
535-7226, 408-395-7000.

List Price: \$595

Requires: 4MB RAM, 8MB
hard disk space, Microsoft
Windows 3.0 or later.

In Short: This capable
omnifont OCR package links
itself to a wide selection of
Windows applications, allowing
users to scan data and text
directly into the program for
which it is intended.

CIRCLE 424 ON READER SERVICE CARD

Bitstream's MakeUp Twists and Turns Your Text

HANDS ON
by Don Trivette

Bitstream's new \$149 *MakeUp* for Windows makes text, headlines, banners, and logos look as if they've been designed in a professional graphics shop. With very little effort you can squeeze, twist, flip, mirror, rotate, shrink, color, wash, emboss, shadow, blend, pour, and otherwise style words and characters to satisfy your most creative whims.

MakeUp is targeted at the professional graphics designer as well as the occasional user. Although the program lacks some of the drawing and CAD-like features of high-end packages such as *CorelDRAW* and *Micrografx's Designer*, *MakeUp* is second to none when it comes to type manipulation. Like most new graphics packages, *MakeUp* takes advantage of Windows' memory management and high-resolution display and printer drivers.

The product ships with five typefaces (Americana Bold, Poster Bodoni, Oz Handicraft, Revue, and VGA Rounded), each of which is available in three popular font formats: PostScript Type 1, Bitstream Speedo, and TrueType. Because the characters are stored as outlines—not as bitmapped graphics—they can be scaled and manipulated without jagged edges or loss of detail.

The *MakeUp* screen is similar to that of other graphics programs, so the experienced designer will feel at home. Clicking on the text tool pops up a window in which you enter text and select format options such as font, character spacing, leading, kerning, and size. A preview box showing how the text will appear is a time-saver for users inexperienced in selecting typefaces. Other tools are used for drawing, text effects, actions, and color assignment.

A separate palette of powerful text tools provides an easy way to shape a character or an

entire word in a single step. You can fit words in and around circles, arches, and curves. Nonsymmetrical effects are applied simply by selecting a pattern from the dozens available in the contour library. Want your name twisted into the shape of an hourglass? Just click on that pattern and *MakeUp* does the rest.

For original effects, an all-points Bezier tool gives you total control over an entire word or a single character.

Although *MakeUp* lacks spot and color separation output capabilities, it does support the three color standards CMYK, HSV, and RGB, as well as the Pantone



Bitstream's *MakeUp* for Windows packs several high-end type manipulation tools into a \$149 package.

process and spot color palette.

With support for a full range of file import/export formats, Bitstream encourages users of other products to switch to *MakeUp* for type enhancements. Among the 22 import formats are .CLP, .DXF, .EPS, .GRF, .IMG, .MAC, .PCX, and .PIF; the 16 export formats include those used by *WordPerfect*, *Lotus 1-2-3*, *Quattro Pro*, *Microsoft Word*, and the SCODL film recorder. More than

200 images are included in a clip-art library. *MakeUp* also supports OLE (object linking and embedding).

List Price: *MakeUp* for Windows, \$149; **Requires:** 2MB RAM (4MB recommended), Microsoft Windows 3.0 or later. Bitstream Inc., 215 First St., Cambridge, MA 02142; 800-522-3668, 617-497-6222.

CIRCLE 417 ON READER SERVICE CARD

Programmable Cartridge Stores 2MB of Fonts

HANDS ON
by Edward Merriam

Kelly Computer Systems' \$599 programmable FontMaster Cartridge for the HP LaserJet series lets you manage the fonts in a laser printer cartridge with the same freedom and flexibility you have with the fonts on your disk, with far fewer headaches. The cartridge lets you install up to 2MB of bitmapped or scalable soft fonts, logos, signatures, and forms, and use them transparently in Windows, *WordPerfect*, *Microsoft Word*, or *Ventura Publisher*. (A 1MB model costs \$499.) Automated installation does most of the work for you. If you don't have the fonts you need, the package comes with disks that provide 100 bitmapped versions of the most popular designs.

You get similar flexibility with Pacific Data Products' pioneering FontBank programmable cartridge (\$399 with 1.5MB of RAM; \$299 with 750K), but the FontBank uses a more obscure installation program, does not come with soft fonts, and makes it difficult to use the same cartridge in more than one application—a trick that Font-

Master handles smoothly.

For corporate settings and sophisticated users, FontMaster offers capabilities normally available only to cartridge manufacturers. An optional \$749 Parallel Programmer—an add-on box the same size as an external drive—lets you program cartridges in about 30 seconds, instead of the 5 minutes required by the standalone package. The Parallel Programmer also lets you read the contents of FontMaster or other vendors' cartridges onto your hard disk as an image file, and you can then send the file into a FontMaster cartridge to duplicate the first cartridge. (The manual warns that this procedure is governed by copyright law.)

A utility even lets you extract individual fonts from the image file for reuse as soft fonts or in a FontMaster cartridge. The basic package lets you read in the contents of FontMaster cartridges, but you need the Parallel Programmer to read cartridges created by other vendors.

FontMaster, like the FontBank, can use any bitmapped PCL 4 soft font or any scalable PCL 5 font; scalable fonts print only on

HP LaserJet III's. If you store printer macros—forms, borders, logos, and other frequently-used images—in the cartridge, you can access them via word-processor commands explained in the FontMaster manual. Sample macros in the package include a fax form.

The main potential inconvenience of the FontMaster package is its requirement that you use a serial port to plug in the cable that talks to the cartridge during installation. FontBank doesn't need this cable, but it does require potentially confusing switch settings and reconfiguration of the printer.

FontMaster cartridges cost more than their FontBank counterparts, but they have a higher capacity, install more easily, and come with soft fonts. And the Parallel Programmer gives you speed of installation and a degree of control over your cartridges that you won't find anywhere else.

List Price: FontMaster: 2MB, \$599; 1MB, \$499; Parallel Programmer, \$749. **Requires:** HP LaserJet II, III, or compatible; serial port. Kelly Computer Systems, 274 Ferguson Dr., Mountain View, CA 94043; 800-627-2000, 415-960-1010.

CIRCLE 416 ON READER SERVICE CARD

First Looks

Floptical Disk Drive Delivers 21MB of Storage

HANDS ON
by JOHN R. QUINN

If you work with computer graphics, you can never have too many colors, too many pixels, or too much storage space. Consequently, manufacturers have struggled to establish a higher-capacity removable storage standard for years. So far, the GrassRoots 2020i Floptical looks like the best solution—though at \$495 for a complete kit, it isn't likely to become as pervasive as \$70 1.44MB floppy disk drives anytime soon.

Based on Insite Technology's I325VM 21MB 3.5-inch Floptical drive mechanism, the GrassRoots 2020i fits in a standard half-height drive bay. It comes complete with an ISA 8-bit SCSI adapter, all the necessary connecting cables, and one 21MB Floptical disk (20.88MB formatted, 25MB unformatted). An external model for the Macintosh or PC is available for \$595.

Unlike competing removable storage devices, the main attraction of the Insite drive is its backward read/write compatibility with 1.44MB and 720K 3.5-inch floppy disks. Externally, the 21MB disks look identical to 1.44MB floppy disks, though they're far more expensive at \$22 each. A box of five is \$99.

FASTER THAN A FLOPPY

To get the extra megabytes out of a 1.44MB floppy disk, Floptical drives, a patented Insite technology, use two heads. Optical-servo positioning tracks are used with standard magnetic recording tracks. The optical grooves are stamped on the disks, and later the magnetic tracks are added between the grooves. The optical head uses the optical tracks to position the magnetic read/write head so that more tracks—and therefore more data—can be squeezed onto a disk. The increased bit density and 720 rpm rotational speed also means Flopticals perform better than

standard floppy disk drives.

But they won't replace your hard disk. Though a 21MB Floptical performed more than three times as fast as a 1.44MB floppy on PC Magazine Labs' DOS Disk Access test, it still takes six times as long as most 200MB hard disks. Rated average access time for the GrassRoots 2020i is 122 milliseconds, versus 240 ms. for a standard 1.44MB floppy disk drive and about 20

ms. for current hard disks.

The 2020i is compatible with DOS 3.3, 4.01, and 5.0, but a special GrassRoots utility is required to format 20.8MB disks. A quick format takes about 5 minutes. Most of GrassRoots' competition is likely to come from Floptical vendors that will also sell Insite 21MB drives. Expect to see direct market prices in the \$400 range soon. ■

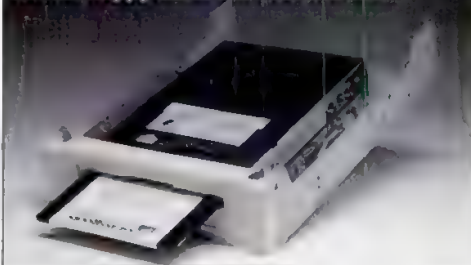
List Price: GrassRoots 2020i, internal model with

adapter and one disk, \$495; external model, \$595.

Requires: DOS 3.3 or later, one 8-bit ISA slot. GrassRoots, 8226 Mieman Rd., Lenexa, KS 66214; 913-681-3001.

CIRCLE 427 ON READER SERVICE CARD

The GrassRoots 2020i Floptical drive fits into a floppy disk drive bay. The disks look like normal floppy disks but cost \$22 each.



CA-UpToDate Color-Codes Your Meeting Schedule

HANDS ON
by JEFFREY WILSON

CA-UpToDate, from Computer Associates, is essentially the same product that was formerly marketed by ASD Software under the name *Planisoft* (First Looks, February 12, 1991). CA bills the \$149 UpToDate as a "Personal/Group Information Manager," but that's something of a misnomer since UpToDate lacks several PIM features (such as to-do list management and indexed free-form notetaking). This Windows program would be better described as a schedule manager; it handles both individual and group scheduling of people and available resources.

UpToDate offers considerable power and flexibility in its approach to representing appointments visually. A spreadsheet-like grid, called an Agenda, displays days across the top and

time (in user-defined intervals as small as 10 minutes) along the left side. Appointments appear as colored blocks on the agenda grid. User-defined groups of people or resources each have their own group agenda display as well. UpToDate checks appointments for conflicts and verifies that all of the individuals in a group are free before scheduling them for a meeting.

MULTICOLOR MEETINGS

The color used on the agenda grid conveys information at a glance. Four "appointment codes"—one from each of four user-definable categories—can be associated with each appointment. The codes, each with a corresponding color, represent some characteristic of the appointment, such as the location or purpose of a meeting.

Poor documentation was the most serious flaw in UpToDate's

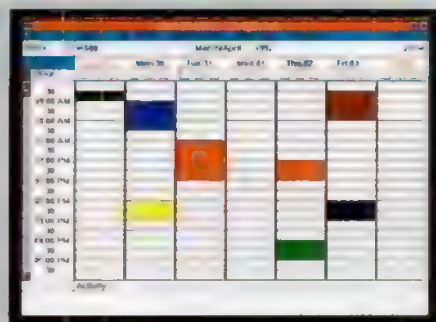
earlier incarnation as *Planisoft*. Computer Associates' new documentation is a vast improvement and makes learning the package as easy as possible given the richness of its feature set and the conceptual complexity of some of its capabilities.

UpToDate has a few deficiencies that CA should address in future releases. Once a group meeting is entered, the details of the meeting can't be modified; you have to delete the meeting and reenter it from scratch. The software runs on networks, but the password access feature does not allow a network administrator to grant differing levels of access. All users have the same level of access to protected features, provided they have the single password. Password protection of individual schedule data is far more flexible; you can grant three different levels of access to your personal agenda.

Average business users may not need a scheduler as powerful and complex as UpToDate. But those who want a flexible, powerful means of planning and tracking the schedules of individuals and resources will find this package up to the task. ■

List Price: CA-UpToDate, Version 2.66, \$149. **Requires:** 1MB RAM, 600K hard disk space, Microsoft Windows 3.0 or later. Computer Associates International Inc., One Computer Associates Plaza, Islandia, NY 11788; 800-225-5224, 516-342-5224.

CIRCLE 428 ON READER SERVICE CARD



CA-UpToDate uses a grid to represent schedules visually. Different colors provide at-a-glance information about appointments.

Scientific Word Makes Technical Documents Much Easier to Write

HANDS ON
by Barry Simon

When Donald Knuth published his first volume on programming algorithms, he was so dissatisfied with the way the book looked that he took several years off from writing to study typography and produce TeX, a typographical markup language.

Now, TCI Software Research's \$595 *Scientific Word*, a Microsoft Windows-based word processor that uses a version of TeX as its native file format, has the potential to revolutionize scientific and technical word processing. It provides a semi-WYSIWYG interface for producing TeX documents.

To produce TeX output, you normally write an ASCII file with sequences of commands and run it through a preprocessor to produce what is called a .DVI (for device independent) binary file. Drivers are available for displaying .DVI files on a screen or printer.

While the TeX language can be obscure, it has wide popularity in some segments of the scientific community. It provides remarkable typographic control while understanding mathematical symbols in a way that PostScript does not. TeX has become

an easy way for scientists to exchange manuscripts. Some journals will accept TeX manuscripts without the need for any further proofreading.

Some scientists have become so fluent in TeX that they almost think in it, but its complexity has been a barrier for others, especially for secretaries who type scientific manuscripts.

Scientific Word uses a dialect of TeX called L^AT_EX as its native file format. Its formula entry is visual and WYSIWYG.

For example, to set the fraction a/b in TeX, you'd need to type in the code `$\frac{a}{b}$`. With *Scientific Word*, you choose the fraction template from the toolbar or enter it with the hotkey, Ctrl-F. On-screen a horizontal bar appears with boxes above and below it. You just type the numerator and denominator into these boxes. When you save the file, the TeX code is saved.

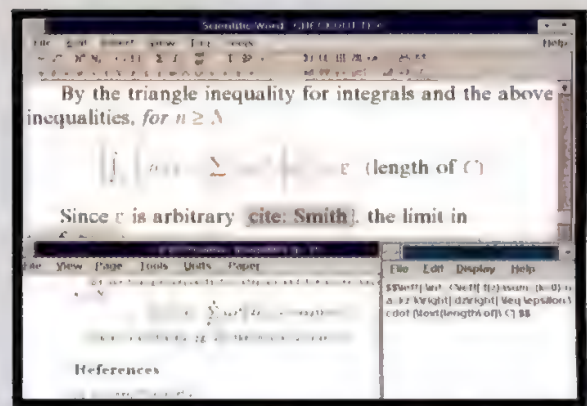
FORMULA WRITING

The program's approach to formula writing is very similar to that of the equation editor for *Ami Pro* 2.0—which is no coincidence, since TCI developed that equation editor for Lotus. *Scientific Word's* TeX support goes beyond *Ami Pro* by saving the entire document in L^AT_EX format, including fonts and styles.

Entry of mathematics is facilitated by a pair of icon bars that lie just below *Scientific Word's* menu bar. There are drop-down palettes of Greek letters, integrals, and other symbols. There are also icons for entering matrices, functions, and a wide variety of brackets.

You can place up to 18 single-symbol entry buttons on the left side of the lower bar and save whole formulae as fragments entered via a pop-up on the status line at the bottom of the screen.

Letters or groups of letters can be decorated with arrows, tildes, and other accents. For the



In this screen, the upper window shows *Scientific Word*, the lower window the output created, and the Clipboard the way the formulas look in the TeX language.

few TeX symbols not supported, you can enter TeX code directly.

For material other than mathematical formulas, *Scientific Word* is not WYSIWYG. You do not see actual page and line breaks on-screen. In fact, lines break in order to fit into the program window and change as that window is resized. While the input mode is not WYSIWYG, there is a L^AT_EX previewer provided in addition to .DVI printer drivers to link to the standard Windows printer drivers.

Such a lack of WYSIWYG is acceptable because scientific documents are so tightly structured. Articles need to have a globally set structure, and the ability to fiddle with the look that we are used to with today's word processors isn't desirable. *Scientific Word* provides 40 global styles, including 12 for articles, 9 for books, and others for exams, faxes, and letters. If you are a TeX expert, you can make styles, but the task is daunting.

Bibliographic, equation, and theorem cross-references are well handled. You can give equations, theorems, and references nicknames and refer to them that way. At printing time, these items are numbered, and references to the nickname are changed to the number. If you later insert an extra equation so that the numbers change, the references update automatically.

Scientific Word comes with a spell-checker and index maker. Support for embedded graphics is limited to EPS files if your printer driver is PostScript or to

HPGL files if your printer is LaserJet-compatible.

MISSING SEARCH

While *Scientific Word* is a sharp program and much of it is well implemented, it does suffer from a few "first version" glitches. For example, Version 1.0 doesn't have search-and-replace, and you can't insert ASCII files.

Reading TeX files produced by other methods can be problematic. TeX files that aren't L^AT_EX can't be read, and you are warned that some L^AT_EX code that is considered badly structured but legal can cause the program to crash. On tests, importing a L^AT_EX file with a missing font caused the previewer to crash into a continuous loop of error messages.

There are also some places where you either have to settle for less than TeX normally provides or else surrender to the complexities of TeX against which you're supposed to be protected.

Previewing and printing was slow, too. On a sample ten-page file without much mathematics, it took 3 minutes to make a .DVI file on a 25-MHz 386 system and another 12 minutes to print on a LaserJet.

Scientific Word's potential is exciting. If TCI addresses the lack of a search-and-replace function and does a better job of importing outside TeX and ASCII files, the program will be great. For now, even with its faults, it's an easy-to-use program that makes producing technical documents a lot less painful. ■



FACT FILE

Scientific Word,
Version 1.0
TCI Software Research Inc.,
1190 Foster Rd., Las Cruces,
NM 88001; 800-874-2383;
505-522-4600.

List Price: \$595 (academic,
\$476).

Requires: 2MB RAM, 10MB
hard disk space, Microsoft
Windows 3.0 or later.

In Short: *Scientific Word* gives
TeX a friendlier interface and
makes preparing technical
documents much easier.

CIRCLE 419 ON READER SERVICE CARD

New
version!

Quattro Pro 4.0 “...the best DOS spreadsheet...”

“We make no bones about it—the innovative Quattro® Pro 4.0
is **the best DOS spreadsheet** you can buy.”

Sebastian Rupley, *PC/Computing*, March 1992

“Quattro Pro 4.0: Improvements add up to **the ultimate DOS spreadsheet.**”

Craig Stinson, *PC Magazine*, April 28, 1992

“... version 4.0 is arguably **the best non-Windows spreadsheet** available ...”

John Walkenbach, *PC World*, March 1992

“Borland is hitting on all cylinders with [Quattro Pro 4.0] ...”

Raphael Needleman, *InfoWorld*, January 27, 1992

“Quattro Pro version 4.0 looks like **the best DOS spreadsheet** ever.”

Jim Seymour, *Office Technology Management*, February 1992

“Verdict: **The best DOS spreadsheet** in the world.”

Mark Whitehorn, *PC User* (U.K.), March 24, 1992



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B O R L A N D

Software Craftsmanship

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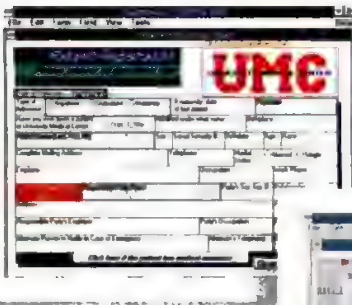
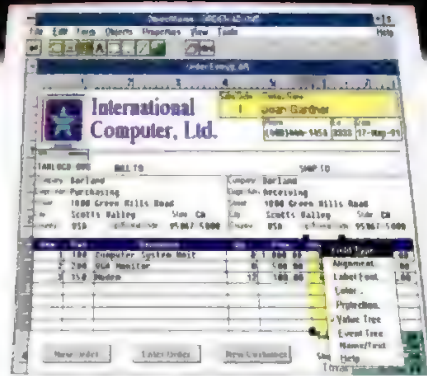
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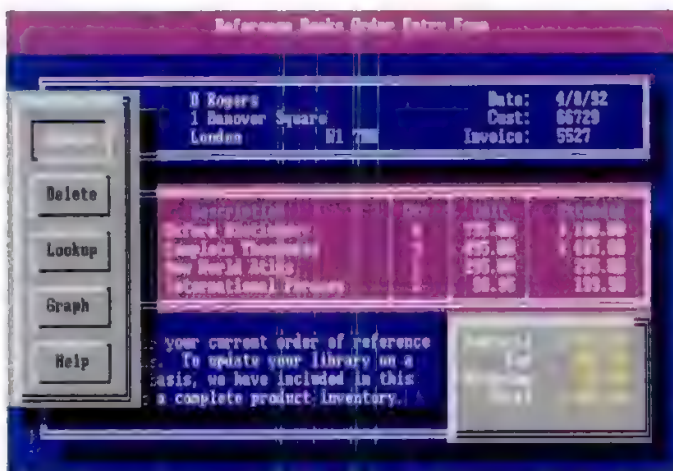
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Rated # 1

Vol. 8, Number 2

February 1991

B O R L A N D

Software Craftsmanship

Time Line for Windows: A Leading DOS Project Manager Goes GUI

HANDS ON
by Henry Perle-Wood

Finally, Symantec Corp. has introduced the long-awaited Windows version of its leading DOS-based project management program, *Time Line*. Not surprisingly, *Time Line for Windows*, Version 1.0, strongly resembles *On Target*, the company's entry-level foray into the Windows environment. However, the functionality is patterned after the DOS version of *Time Line* and the command terminology is pure project management. The graphics and operational design of the program are impressive, but it's disappointing to find many of the new features in *Time Line 5.0* for DOS left out here.

The screens and menus in *Time Line for Windows* look almost indistinguishable from the ones in *On Target*. Some of the menu options have been shifted around, but otherwise you'll have to hunt for the differences. One dramatic difference, though, is the number of icons. *On Target* has but a few; *Time Line for Windows* comes with 35. About a third of the icons control the display appearance. For example, you get five

icons to adjust your task outline. Other display-oriented icons turn things such as slack and dependency lines on or off.

You get the usual print, cut, copy, and paste icons that most Windows apps share, but you also get icons for marking a task 100 percent complete, consolidating schedules, linking tasks, and calling up data entry dialog boxes.

As you would expect in a Windows program, you can add colors liberally, change fonts, and use the mouse interactively to adjust task bar start and duration, open or close the spreadsheet portion of the Gantt view, link tasks, and even assign resources. This last ability makes scheduling significantly easier. Simply by placing the Resource window and the Gantt window next to each other, you can drag a connection between a resource name and a task. This automatically assigns the resource at its default value.

The default project planning view in *Time Line* is the Gantt chart. It has two windowpanes: The left one holds a spreadsheet and the right one has a bar chart under a time scale. When you

enter tasks in the spreadsheet, you can organize them by phases or projects using an outline format. The outline structure automatically ensures summarization on parent levels. You can also assign work breakdown structure numbers to outline levels, but the codes have to be entered manually and will not automatically tie in with the outline structure. While this makes it harder to use WBS codes, it means you can summarize project data in two different ways; for example, by project phase and by corporate division.

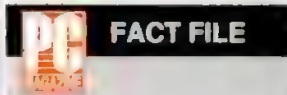
You can enlarge the spreadsheet area by dragging the pane divider. The spreadsheet can hold a large number of columns chosen from a list of 180 data fields covering all aspects of a project, from schedule dates to resource allocations to progress calculations. You can also change the names of the data columns to suit your style. For example, you might change "WBS" to read "Division Codes."

The Gantt and spreadsheet combination makes entering data easy, and it has a very clean, uncluttered appearance. You can enter data in any cell of the spreadsheet, or you can call up small dialog boxes for entering task, resource, dependency, and note information. These dialog boxes are small enough to leave on-screen while you work interactively in the Gantt chart. As you move from one task to another, the information box changes, too.

BUILT-IN ASSISTANCE

Time Line for Windows has an enhanced version of the Schedule Assistant tool that appeared in *On Target*. Co-Pilot pops up whenever you perform a task that may seem ambiguous. For example, if you drag a task bar to a position that follows another bar, Co-Pilot will ask if you want to set a dependency or set a fixed start date. Fortunately, the helpful utility stays out of the way when you don't need it.

While many of the program's first impressions will be conveyed by its graphics and intuitive command structure, *Time Line for Windows* gives you a solid, basic set of project management tools. You can schedule up to 8,000 tasks and 1,000



Time Line for Windows, Version 1.0
Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 800-441-7234, 408-252-3570.
List Price: \$699; upgrade from *Time Line 5.0*, \$179; upgrade from *On Target*, \$199; upgrade from any other project manager, \$199; LAN node, \$599
Requires: 2MB RAM, 4.5MB hard disk space, Microsoft Windows 3.0 or later.
In Short: *Time Line for Windows* carries forward the design efforts that went into Symantec's first Windows project manager, *On Target*. The screens and menus look almost exactly the same. However, *Time Line for Windows* has added a great many more icons and enhanced the Schedule Assistant feature.

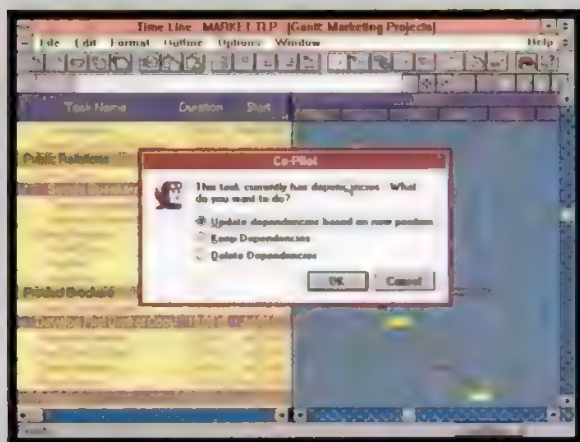
CIRCLE 418 ON READER SERVICE CARD

resources in a project; schedule durations down to one-tenth of an hour; use ASAP, ALAP, or simple fixed-date task types; use effort-driven scheduling; add general task costs; and more.

The resource management tools are also solid. You can enter a default assignment, maximum availability, standard work week, and cost rate for each resource. You cannot vary availability by time as you can in *Time Line 5.0*, however. Nor can you make sophisticated assignments based on specific days during a task duration.

Time Line for Windows' tracking facilities work with actual dates and percent completions. You also get a good set of baseline and variance reports to round out the picture.

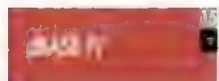
Though *Time Line for Windows* hasn't matched the feature richness of its DOS companion, it's a good start, and the program is a potential competitor for the more firmly established *Microsoft Project for Windows*. It's been a long wait for people who wanted the power and sophistication of *Time Line* translated into Windows, and though in a sense the wait isn't over, *Time Line for Windows* does get the best out of Windows without adding to the complexity of project management. ■



Time Line for Windows includes Co-Pilot, a helpful utility that pops up to ask questions about your intentions when you take ambiguous steps with your project.

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support

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Superior programmability for complex applications

Now up to 40 open work areas are possible at any one time, offering greater flexibility for more complex applications. Enhanced BLANK support gives you the power to detect empty fields for data validation and statistical operations. Plus, the widely

respected dBASE Template Language is now standard in dBASE IV v1.5.

A great product begins with the basics

Behind the new features of dBASE IV v1.5 lies the flexibility of a worldwide standard. No other database software is available on more platforms than dBASE. Add that to the dBASE Control Center with its road-tested design tools and the dBASE Programming Language, featuring integrated IBM's SAA-compliant SQL, integrated debugger, and built-in applications generator, and you have the most well-rounded database management and application development product in the world.

Technology you can build upon

There are no stop signs ahead for dBASE IV v1.5 thanks to its Open Architecture Control Center, allowing you to add third-party designers to your crew—and access additional tools—at any time.

Borland: the new force behind dBASE

dBASE IV v1.5 marks a return of innovation and pride to the dBASE community. And now



that dBASE IV v1.5 is part of the Borland family, you can expect Borland's world-renowned service and support. Now is the time to join the more than three million people who already drive dBASE.



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CIRCLE 398 ON READER SERVICE CARD

HyperChem: Complex Chemistry in Windows

HANDS ON
by Barry Simon

Whether they're into pharmaceutical development or designer genes, practicing chemists will want a copy of Autodesk's *HyperChem*. It brings calculational chemistry to Windows with beautiful results. Considerable financial and hardware resources are needed to run the program. *HyperChem* costs \$3,500 (\$595 for the academic version) and requires a 386 PC or better, since the program runs only in Windows 386 Enhanced mode, and a math coprocessor or a 486DX. But for excellent molecular analysis, it's worth the expense. You'll be amazed by what this program can do.

There are three methods for defining the molecules you want to analyze. The program comes with drawing tools that let you draw schematics, and a dialog box lets you assign which atomic elements will be at the vertices of the schematic. A second method allows you to string together amino acids or nucleic acids to form proteins and nucleotides. Finally, you can access macro molecules if you have the data in Brookhaven PDB format.

TWO ANALYSIS METHODS

You can analyze the molecule either classically or in terms of quantum mechanics. The classical approach (molecular mechanics) essentially uses a ball-and-spring model. You can choose one of four different force fields, each from a different academic research group, to model the molecular connections. This is also where you can find equilibrium configurations or model molecular dynamics.

The quantum mechanical analysis involves a restricted Hartree-Fock self-consistent field. The methods are semi-empirical in that the orbit overlaps are based on experimentation rather than the evaluation of integrals. As with the classical approach,

there is a choice of analytical methods—six in all.

As an informal test, we did an electron density calculation for pyrene (a molecule with 16 carbons and 14 hydrogens in four aromatic rings), which took about 10 minutes. Quantum calculations on sections of really big molecules can take hours.

The Windows-based interface has a tools palette that lets you easily rotate your viewpoint and sketch in extra groups. But the interface is uneven. For example, it sometimes requires the use of both mouse buttons at once, and the behavior is different depending on which button is pressed first. The program can act as a DDE (dynamic data exchange) server.

HyperChem's documentation is outstanding, with a lucid tutorial and extensive explanations of quantum chemistry in general

and the methods used in the program in particular. The tutorial includes directions for driving *HyperChem* from Microsoft Excel or Visual Basic via DDE. An otherwise superb package is marred by copy protection via a parallel-port key. As with AutoCAD, support is provided only through dealers.

Not everyone will appreciate *HyperChem*, but those who do will appreciate it greatly. ■



HyperChem can display models of large molecules. This one is composed of over 2,000 atoms.

List Price: *HyperChem*, Release 2 for Windows, \$3,500; \$595 for academic users.

Autodesk, 2320 Marinship Way, Sausalito, CA 94965; 800-424-9737.

Requires: 4MB RAM (6MB recommended), 20MB hard disk space (including swap file), Microsoft Windows 3.0 or later, math coprocessor. Copy protected.

CIRCLE 423 ON READER SERVICE CARD

Create Multiple Start-up Scenarios with BootCon

HANDS ON
by Tony Pompili

When memory managers conflict with TSRs and applications lose memory to network drivers, Modular Software Systems' \$79 *BootCon*, a program for managing multiple boot configurations, is the perfect mediator.

Suppose you want to load *QEMM* most of the time but not when you run *Paradox 386*. Creating *Paradox* and *QEMM* versions of your CONFIG.SYS and AUTOEXEC.BAT files is possible, but it is a tiresome process. *BootCon* merges what would normally be an annoying root directory full of various boot files into a single CONFIG.SYS and AUTOEXEC.BAT pair.

The program manages up to 26 start-up configurations, selectable from a pop-up menu on start-up. For example, one group called CD-ROM might include the Hitachi CD-ROM driver, while

a Scanner group might include the Datacopy driver. Associated AUTOEXEC.BAT commands, such as loading Microsoft's CD-ROM Extensions to read CD-ROMs, are grouped appropriately and would automatically run when the CD-ROM group is selected.

BootCon is installed as a CONFIG.SYS driver and is loaded before any of the defined groups. Other CONFIG.SYS and AUTOEXEC.BAT commands common to all configuration groups, such as BUFFERS= and FILES=, can be loaded prior to anything else and will apply to all configurations.

Similar functionality is more crudely implemented in Digital Research's DR DOS 6.0 and *PC Magazine*'s own CONFIG.CTL, both of which allow you to mark specific drivers for manual exclusion on boot-up. *BootCon* simplifies this process with its pop-up menus and can select entire

groups of commands with a single selection. It uses a maximum of 450 bytes of memory, but in our tests, *BootCon* never used more than 320 bytes.

By default, *BootCon* waits 10 seconds and then launches the first configuration choice on its menu, allowing the PC to boot even if there is no one is around.

Version 1.6 is compatible with DOS 5.0 and supports loading DOS high or low. (*BootCon* is not compatible with DR DOS 6.0.) Other improvements in the new version include a new syntax analyzer that flags coding problems.

Modular Software Systems has also added improved password protection, letting you change the password without having to reinstall the software. ■

List Price: *BootCon*, Version 1.6, \$79; upgrade, \$18.

Requires: 256K RAM, DOS 3.1 or later. Modular Software Systems, 25825 104th Ave. SE, #208, Kent, WA 98031; 800-438-3930, 206-631-5781.

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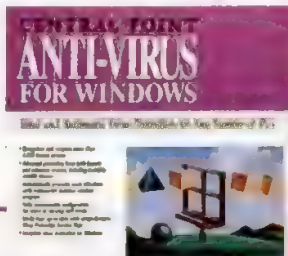
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CIRCLE 120 ON READER SERVICE CARD

by
Emerson Andrew
Torgan

New & Improved

News of Announced Products and Upgrades

PostScript Level 2 Color Printing Under \$5,000

NEW Tektronix has unveiled the Phaser II PXe color printer. The PostScript Level 2 thermal wax transfer unit provides 300-dot-per-inch print resolution and can be shared on a network. It comes standard with parallel, serial, and AppleTalk ports, 4MB of RAM (upgradable to 8MB), and 17 Adobe fonts. An optional Tektronix 4511A interface enables connectivity across Ethernet networks using TCP/IP protocols.

Designed to meet the high-volume demands of business graphics, the Phaser II PXe utilizes a 16-MHz AMD RISC processor for fast image processing, according to the company. It uses either a three-color or black-only



Shared across a network, the Phaser II PXe is an affordable color printing solution for business graphics.

wax transfer ribbon and supports letter and legal size paper, as well as transparency film. The printer ships with an upgrade of Tektronix's color adjustment software utility, *TekColor*

PS, Version 2.0, with enhanced color rendering tables to refine color quality and an on-screen print preview.

List Price: Phaser II PXe, \$4,995. Tektronix Inc., P.O. Box 1000, MS 63-583, Wilsonville, OR 97070; 800-835-6100, 503-682-7377.

CIRCLE 402 ON READER SERVICE CARD

PC Manufacturers Gear Up to Deliver DX2 Machines

NEW The Intel 486 DX2 processor is here, and PC manufacturers are taking advantage of its speed-doubling technology. A number of companies are either now shipping or have announced support for the chip, which promises to boost system performance by as much as 70 percent. Two of the early entries into the DX2 arena include the Compaq Deskpro 50/M (First Looks, April 14, 1992) and the Tandy 4850 EP (First Looks, April 28, 1992).

Dell is rolling out four new upgradable PCs based on the speed-doubling power of the DX2 chip. The Dell System 486P/50, designed as an entry-level unit offering three 16-bit expansion slots, is available configured with 4MB RAM, a 100MB hard disk, one floppy disk drive (either 5.25-inch or 3.5-inch), and a VGA Color Plus monitor. The Dell System 486D/50 is available in a similar configuration with three additional expansion slots.

Dell's PowerLine series of 32-bit EISA units includes the new desktop PowerLine 450DE/2 and the PowerLine 450SE/2 tower model. Each has 4MB RAM, a 230MB hard disk, one floppy disk drive (either 5.25-inch or 3.5-inch), and a VGA Color Plus monitor. All four PCs ship with the company's programmable flash EPROM BIOS for system BIOS upgrades via floppy disk.

(For a list of additional manufacturers who are either shipping DX2-based PCs or have announced support for the speed-doubling chip, see Briefs, page 60.)

List Price: Dell System 486P/50 with 4MB RAM and 100MB hard disk, \$2,799; Dell System 486D/50 with 4MB RAM and 100MB hard disk, \$3,179; PowerLine 450DE/2 with 4MB RAM and 230MB hard disk, \$4,599; PowerLine 450SE/2 with 4MB RAM and 230MB hard disk, \$6,599. Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; 800-289-3355, 512-338-4400.

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HOT PROSPECT

INTEL DEBUTS NEW LINE OF AFFORDABLE FAX MODEMS AND FAX SOFTWARE

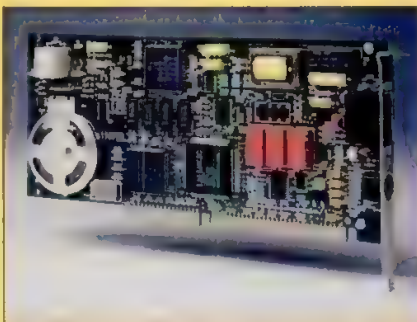
Intel wants to put more than a chip inside your PC. The company has unveiled a new line of low-cost internal fax modems and fax software for both DOS and Windows.

With prices starting as low as \$129, the Group 3-compatible SatisFAXtion modem line consists of three internal units. The SatisFAXtion Modem/100 provides a fax sending rate of 9,600 bps, a fax receiving rate of 4,800 bps, and a modem speed of 2,400 bps. The SatisFAXtion Modem/200 provides a fax transmission rate of 9,600 bps, a modem speed of 2,400 bps, V.42bis data compression for a maximum data throughput rate of 9,600 bps, and V.42 error correction.

The SatisFAXtion Modem/400 features a coprocessed architecture for high-speed buffering that prevents data loss, V.42 error correction, and full-duplex (V.32bis) data and fax transmission rates up to 14,400 bps. The Modem/400 is V.42bis-compatible, providing a maximum throughput rate of up to 57,600 bps, according to the company.

Intel is also offering new fax software supporting the SatisFAXtion line or any fax modem that complies with CAS, Class 1, Class 2 (still under development), or the Sierra Sendfax interface. *FAXability Plus* and *FAXability Plus/OCR* let users transmit faxes from within any Windows application. *FAXability Plus/OCR* provides optical character recognition capability and supports the TWAIN interface.

List Price: The SatisFAXtion Modem/100, \$129; SatisFAXtion Modem/200, \$369; SatisFAXtion Modem/400, \$499; *FAXability Plus*, \$129; *FAXability Plus/OCR*, \$249. Intel Corp., 3065 Bowers Ave., P.O. Box 58065, Santa Clara, CA 95052; 800-538-3373, 503-629-7354.



The SatisFAXtion Modem/400 features a coprocessed architecture and speed optimization during transmission.

CIRCLE 401 ON READER SERVICE CARD

New & Improved

BRIEFS



MORE DX2 MACHINES ON THE WAY

Acer America has announced that its AcerPower 486SX and 486/33, which include ChipUp technology, will support the DX2 chip. 800-733-2237, 408-432-6200.

Advanced Logic Research will ship BusinessVEISA and PowerPro systems based on the DX2. 800-444-4257, 714-581-6770.

American Megatrends' Super Voyager 486/50-MHz motherboard, which operates at 22.3 million instructions per second, accepts the DX2. 800-828-9264, 404-263-8181.

AST Research's hardware design supports the DX2, and the company plans to ship DX2-based units. 800-876-4278, 714-727-4141.

CompuAdd's new 486 system board, featured in the CompuAdd 420, 420s, and 433, accepts the DX2 chip, and the company plans to ship DX2-based units. 800-456-3116, 800-627-1967.

Epson plans to ship the Equity 486DX2/50 PLUS and the Epson ExpressStation. 800-289-3776.

Everex is shipping the Tempo M 486DX2/50 ISA (\$4,899) and the STEP 486DX2/50 EISA (\$5,999). 800-992-3839, 510-498-1111.

Gateway 2000 is shipping a 486DX2 ISA system (\$3,195) and a 486DX2 EISA system (\$4,095). 800-523-2000, 605-232-2000.

GRID Systems is shipping the GRiD APT/450e (\$4,499) and the GRiD MFP/450 (\$2,599). 800-222-4743, 510-656-4700.

Hewlett-Packard plans to offer a DX2-based PC. 800-752-0900.

IBM plans to include chip support for the DX2 in future PS/2 systems. 800-426-2468.

Micronics' line of 486 system boards supports the DX2 chip. 800-659-5901, 510-651-2300.

CONTINUES ON PAGE 64

Ziff Unveils PC Technical Support Tool on CD-ROM

NEW **Computer Library**, a division of Ziff Communications (parent company of *PC Magazine*), has released *Support On Site for Applications*, a CD-ROM database of technical support information on over two dozen software products. The extensive database, designed to help organizations boost the productivity of their technical support staff, is available as an annual subscription and is updated monthly.

Support On Site combines proprietary tech notes, software, manuals, and white papers from the publisher's own staffs with application-specific books, newsletters, related information, and other industry sources. All the information is accessed via search-and-retrieve software that lets users search by word, combinations of words, fields, Boolean operators, and wildcards.

The initial release has information on DOS and Windows as well as applications such as *Aldus PageMaker*, *Lotus 1-2-3 for Windows*, *Paradox*, *WordPerfect*, and *PowerPoint*. Future CDs will include new applications as well as additional information on those previously covered.

List Price: *Support On Site for Applications*, \$1,295 for single-user annual subscription; \$4,995 for five users on a network. Computer Library, One Park Ave., New York, NY 10016; 800-827-7889 ext. 317, 212-503-4400.

CIRCLE 404 ON READER SERVICE CARD

Freelance Graphics Now Supports Networks, NewWave

IMPROVED **Lotus Development Corp.** is now shipping a network version of *Freelance Graphics for Windows* with network administration capabilities and support for Hewlett-Packard's *NewWave*. Designed to integrate with Lotus's suite of Windows applications, the program can access common resources such as symbols, graphics, Smart Master sets, and libraries of presentations.

Outlines created in *Ami Pro* and charts created in *Lotus 1-2-3 for Windows* can be copied into the package to generate presentations. Users of *Lotus Notes* can attach *Freelance Graphics* presentations to messages and launch them with a mouse click.

NewWave, Hewlett-Packard's desktop manager for Windows, gives *Freelance Graphics for Windows* users access to its desktop organizer, LAN access capabilities, and information integration. The network version of *Freelance Graphics for Windows* ships with *NewWave* support. Users of the standalone version can order support for *NewWave* free (800-843-5414). The package operates on net-

work operating systems that support Windows 3.0, such as *NetWare 386*, Version 3.11, and *VINES*, Version 4.1.

List Price: *Freelance Graphics for Windows*, Network Server Edition, \$795; concurrent licenses, \$495 for each Node Edition. Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 617-577-8500.

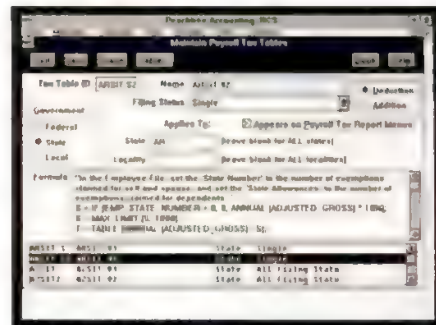
CIRCLE 405 ON READER SERVICE CARD

Peachtree Lowers The Price of Accounting

NEW In an effort to get a stronger foothold in the small-business marketplace, **Peachtree Software** is offering *Peachtree Complete III Basic Accounting*, a simplified version of *Peachtree Complete III*, with a price tag of \$99. The package has General Ledger, Budgeting, Accounts Payable, Accounts Receivable, Invoicing, Inventory, Auditing, and Management Reporting sections.

The new version includes a quick-start guide, sample company data, and an on-line tutorial for each module. It is compatible with *Peachtree Complete III*, *Peachtree Data Query*, and *Bank Account Manager*, the company's check-reconciliation program. *PeachPay*, the company's payroll system, can be integrated with *Peachtree Complete III Basic Accounting* to calculate taxes and print paychecks or tax forms.

Peachtree is also shipping *Peachtree Accounting for Windows*, Version 5.0 (formerly



Peachtree Complete III Basic Accounting meets the demands of a small business without driving its owners into debt.

Crystal Accounting), at an introductory price of \$99. The update sports a new toolbar, is fully Windows 3.1 compatible, and supports OLE (object linking and embedding), TrueType, and Windows help. Job Costing, Inventory, Bank Reconciliation, and Custom Forms Design features have been added.

List Price: *Peachtree Complete III Basic Accounting*, \$99. *Peachtree Accounting for Windows*, Version 5.0, \$249; introductory price, \$99. Peachtree Software, 1505 Pavilion Pl., Norcross, GA 30093; 800-247-3224, 404-564-5800.

CIRCLE 406 ON READER SERVICE CARD

Suite Deal.

Four great Windows™ products from Lotus®—Freelance Graphics,™ AmiPro,™ 1-2-3® and cc:Mail™—now at a great price.



1-2-3 for Windows, the World's Most Popular Spreadsheet,™ takes full advantage of the Windows operating environment, and is still everything you love about 1-2-3. And we've just come out with a new point release, 1.1, with improved speed and performance.



Ami Pro 2.0 is the most powerful and enjoyable word processor you can buy. And it's also the fastest and easiest way to create professional looking documents.



Freelance Graphics is today's easiest presentation graphics package. It includes QuickStart, an on-line tutorial which leads you step by step through the entire process, and SmartMasters, which automatically manages the design of your presentation.



cc:Mail is the world's leading e-mail package. All SmartSuite applications are mail-enabled with cc:Mail so you can send mail from any one of them.



If you're looking for a complete Windows solution, Lotus SmartSuite® is your answer. And for a limited time, you can purchase these four outstanding Windows products for less than the price you'd ordinarily pay for two.*

Each SmartSuite application includes our unique SmartIcons™ for one-click access to virtually all of the products' features. And each has

a common interface that makes the learning curve a lot smoother.

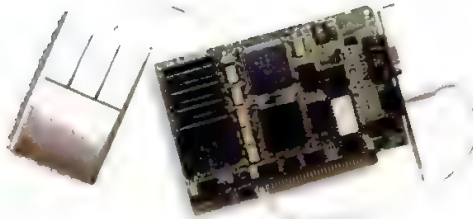
Plus, to make things even easier, we've included a free Windows tutorial from Personal Training Systems.® To order,** call 1-800-TRADE-UP, ext. 6639. Because a deal like this is too sweet to pass up.

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(suggested upgrade)

Lotus SmartSuite for Windows

*Based on suggested retail prices. **Please have your credit card and product package ready when you call. Offer expires September 30, 1992 or while supplies last. Education priced Lotus products not included. Not to be combined with any other offer. In Canada call 1-800-60-LOTUS. ©1992 Lotus Development Corporation. All rights reserved. Lotus and 1-2-3 are registered trademarks and Freelance Graphics, Ami Pro, The World's Most Popular Spreadsheet, SmartIcons, SmartSuite and SmartMasters are trademarks of Lotus Development Corporation. cc:Mail is a trademark of cc:Mail, Incorporated, a wholly-owned subsidiary of Lotus Development Corporation. Windows is a trademark of Microsoft Corporation. Personal Training Systems is a registered trademark of Personal Training Systems, Inc.

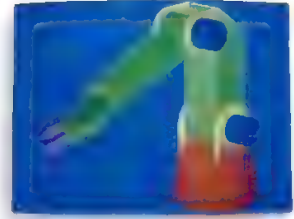
VALUABLE PRIZES



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and a 76Hz refresh rate
24X faster than SVGA.



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Co-processed video & Vibrant's
DLD driver make the Power
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They're here. Our all new, expanded line of Windows Workstations. When it comes to all-out Windows and CAD performance, Standard Computer just made the best even better. We've assembled some of the most highly acclaimed components and software into a series of systems with one objective: to give you the hottest video, the highest overall system performance and the best user

Team the Graphics Ultra up with one of MAG's two top of the line monitors and you're looking brilliant – up to 1280 X 1024 resolution and up to a 76Hz refresh rate.

We think you'll find HyperDisk's disk caching software –

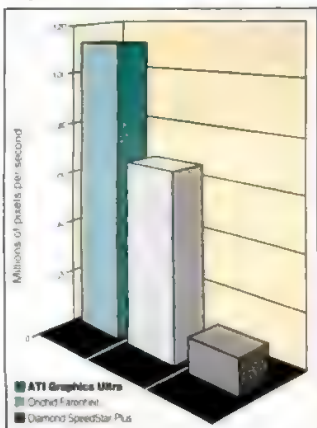
for up to 1000% faster disk drive performance – refreshing as well.

Looking for a better user interface? Well we anticipated that too and included The Norton Desktop for Windows. And if all this isn't enough, we

also include The Complete PC's Complete Modem Plus, Windows 3.0, DOS 5.0, a 130-key keyboard and a three-button mouse from ATI. It's all in there. There's nothing like the Power Windows Series from Standard Computer. Anywhere. At any price.



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interface – courtesy of Norton Desktop for Windows – on the market today.



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the award-winning ATI Graphics Ultra GUI Accelerator Card, one of the most powerful graphics engines out there. How powerful? How about video speed up to 24 times faster than SVGA.



- ▼ ATI Graphics Ultra Co-processed SVGA card. 1MB VRAM & 512Kb DRAM. Up to 1280 X 1024 resolution & a 76 Hz refresh rate. Built-in mouse port with 3-button mouse included.
- ▼ MAG 17" flat screen monitor. Up to 1280 X 1024 resolution & a 76Hz refresh rate. LCD info display and digital image sizing control.
- ▼ Free Norton Desktop for Windows.
- ▼ Free 9600/2400 Baud FAX / Modem.

- ▼ 8MB 70ns RAM with 64K SRAM cache.
- ▼ 340MB <15ms IDE HDD w/64K cache.
- ▼ HyperDisk disk drive accelerator.
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- ▼ MAG 15" flat screen monitor. Up to 1280 X 1024 resolution & a 76Hz refresh rate. LED mode indicator and Digital image sizing control included.
- ▼ Free Norton Desktop for Windows.
- ▼ Free 9600/2400 Baud FAX / Modem.

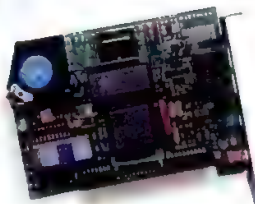
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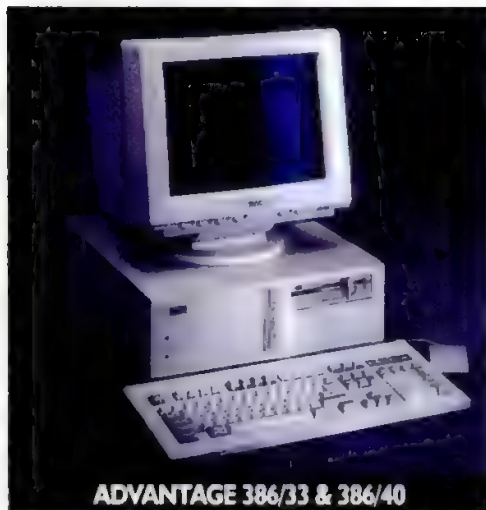
gy turns 32,768 colors into an effective 262,144. Up to a 72Hz refresh rate at all resolutions and an ATI three-button mouse make this SVGA card unbeatable. Next came the MAG 14" multi-frequency color monitor, which supports the



ATI VGA XL beautifully with full control over image sizing and positioning. You'll also get Norton Desktop and HyperDisk disk accelerator.

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- ▼ 130MB <15ms IDE HDD with 64K look ahead cache buffer.
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- ▼ 101-key keyboard.
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- ▼ Free Norton Desktop for Windows.
- ▼ 4MB 70ns RAM with 64K SRAM cache.

- ▼ 210MB <15ms IDE HDD with 32K look ahead cache buffer.
- ▼ HyperDisk disk accelerator software for up to 1000% greater disk drive performance.
- ▼ 1.44MB and 1.2MB genuine TEAC floppy drives.
- ▼ 2 serial, 1 parallel, & 1 game port.
- ▼ 101-key keyboard.
- ▼ Free 2400 Baud Modem.
- ▼ MS DOS 5.0 and Windows 3.0.

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CIRCLE 163 ON READER SERVICE CARD

New & Improved

BRIEFS

CONTINUED FROM PAGE 60

Mitac plans to ship the 4270I DX2-based PC. 800-648-2287, 408-432-1160.

Mylex plans to ship three new system boards: the MAE486 EISA configured with the DX2 chip; the upgradable MDI486 DX-based ISA system board; and the upgradable MSI486 SX-based ISA system board. 800-776-9539, 510-796-6100.

NCR plans to ship the NCR 3335 DX2-based PC. 800-225-5627.

Northgate's Elegance ZXP systems are compatible with the DX2, and the company plans to ship DX2-based PCs. 800-548-1993, 612-943-8181.

Wyse Technology is planning to ship the Decision 486/50DX2 series of DX2-based PCs. 408-473-1200.

Zeos is offering the DX2 chip as an option for its existing line of upgradable PCs. 800-423-5891.



ANTIVIRUS PRODUCTS

Central Point Software is now shipping *Central Point Anti-Virus for Windows*

(\$129), supporting Windows 3.1. The new version features scheduled scanning, automatic updating, and delete and wipe options for infected files. 800-445-4208, 503-690-8090.

Corporate Management Group

believes that the best virus defense is a locked system. The company has a variety of disk locking units and motion sensor alarms. NoteLock locks notebook PC systems closed. LamaLock is a bezel lock for floppy drives on desktop PCs. Prices range from \$29.95 to \$89.95. 512-329-8220.

Multix's ViruStop PC Immunizer Card (\$69) monitors the PC bus and detects operation patterns typical of computer viruses. If a virus is detected, all functions are suspended. 214-239-4989.

XTree has unveiled *AllSafe*, Version 1.0 (\$129), *VirusSafe/LAN*, Version 1.0 (\$595), and *SWAT—Software Warriors Against Tampering*, a comic book that

CONTINUES ON PAGE 66

Xircom Unveils Pocket Token Ring Adapter II

NEW Designed with an eye toward ergonomics, Xircom's Pocket Token Ring Adapter II sports a unique tractor grip for connection in a smaller and lighter housing. The unit provides LAN and mainframe connectivity via the parallel port of a notebook or a desktop PC and supports 4-megabit-per-second and 16Mb-per-second networks.

The Pocket Token Ring Adapter II ships with a complete range of drivers for Novell's IPX/SPX; ODI; and NDIS, a LAN support program with support for all major network operating systems, according to the company. *SmartRing* software is included, minimizing driver memory requirements on the PC by loading code into the adapter's memory. The unit has a set of LEDs to indicate ring insertion, power, and 16Mb-per-second operation.

List Price: Xircom Pocket Token Ring Adapter II, \$795. Xircom, 26025 Mureau Rd., Calabasas, CA 91302; 800-874-7875, 818-878-7600.

CIRCLE 407 ON READER SERVICE CARD

QMAPS 2.1 Promises 40 Percent Gain in Upper Memory

IMPROVED Quadtel Corp. is now shipping an update to its memory management program, with a new lower price tag. *QMAPS*, Version 2.1, provides users with a minimum of 32K of additional upper memory, and as much as 64K when a Quadtel BIOS is installed, according to the company. *QMAPS* and Quadtel's extended memory manager and high-memory loader, *UMBPro*, are now priced at \$99.95 and \$79.95, respectively. Registered users of *QMAPS*, Version 2.0, can get free upgrades to Version 2.1 through the end of 1992.

Additional enhancements to the program include automatic detection and configuration to support Windows 3.0 and 3.1, use of the video text area to add approximately 32K of upper memory, and support for *NetWare* and *LANtastic* networks.

List Price: *QMAPS*, Version 2.1, \$99.95. Quadtel Corp., 3190-J Airport Loop, Costa Mesa, CA 92626; 800-748-5718, 714-754-4422.

CIRCLE 408 ON READER SERVICE CARD

Personal LFR: Top-Quality Slides For Under \$6,000

NEW Lasergraphics, manufacturer of rasterizers and color printing systems, has added a new product to its line of film recorders. Personal LFR, the company's entry-level digital

film recorder, gives users the ability to produce 4,000-line color slides in 90 seconds for \$5,995.

The desktop unit sports a permanently mounted 35-millimeter camera back (the SmartBack), which provides reliable optical alignment and image quality, according to the company. It produces either 2,000- or 4,000-line slides and has 33 bits of color per pixel (11 bits per primary color to eliminate banding). Personal LFR is available in a dual host configuration (\$6,995), supporting both PC and Macintosh platforms.

List Price: Personal LFR, \$5,995.

Lasergraphics Inc., 20 Ada, Irvine, CA 92718; 714-727-2651.

CIRCLE 409 ON READER SERVICE CARD

Swans! Mirrors! More Fish!

IMPROVED Berkeley Systems, maker of the popular screen saver *After Dark for Windows*, is now shipping a new version that incorporates digitized sound (the fish tank bubbles, coyotes howl), True Color graphics, and a host of new displays. *After Dark for Windows*, Version 2.0, has over 40 displays including the new Swan Lake, Hall of Mirrors, and bouncing Marbles.

The package has a new Windows wallpaper creator in the form of a screen capture utility called WallZapper. When running *After Dark*, users can capture and save a screen as a .BMP file that replaces the existing wallpaper. A new MultiModule feature lets users mix different screens to create custom displays. A Sounder module provides a choice of sounds for the new screens. The package ships with sample MultiModules. Support for Creative Labs' Sound Blaster sound card and Microsoft's Multimedia sound is standard, allowing users to escape the standard audio limitations of the PC's internal speaker.

After Dark 2.0 also blanks screens in the DOS environment, even if Windows is not running, and now supports networks and a two-level password-protection system. Inci-

CONTINUES ON PAGE 66



MultiModule lets you combine portions of various displays to create a custom screen saver, such as "AstroFish!"

*Our features suggest
a computer of entirely
different dimensions.*

Like other
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the AcerAnyWare™ series have 8½" x 11" footprints.
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lets you change batteries
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board, to eliminate double keystrokes. A 10-inch
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handle that flips down for a
more comfortable keyboard angle.

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You'll think of them as desktop computers for very
small desks. At a very small price.



Acer

New & Improved

BRIEFS

CONTINUED FROM PAGE 64

illustrates the importance of PC security. 800-366-6067.



MODEMS

Boca Research is shipping the V.32bis 14.4K-per-second Internal Modem (\$395), its high-end addition to the BocaModem family. The unit features Group III send/receive fax capabilities and fax software. 407-997-6277.

Cardinal Technologies is shipping the WIN24SR Windows fax modem (\$229) bundled with the company's proprietary *FLASHlink Fax for Windows* software. The unit provides 9,600-bps send/receive fax capabilities and a 2,400-bps data-transfer rate. 800-233-0187, 717-293-3000.

Computer Peripherals is shipping the full duplex ViVa 14.4/FAX V.32bis modem (\$649). The modem provides data and fax transmission rates of 14,400 bps. It provides V.32bis, V.42bis, and MNP 5 data compression, and has a maximum throughput rate of up to 57,600 bps. 800-854-7600, 805-499-5751.

Tidal Technology's Portable Fax Modem (\$249) is a pocket-size unit that provides 9,600-bps send/receive fax capabilities and a 2,400-bps data-transfer rate. It supports MNP 2, 4, 5, and 7 data-compression and error-correction standards, and ships with data communications and fax software. 510-748-7272.

Piiceon is shipping a V.32bis, 14,400-bps internal fax modem (\$1,195) for the Compaq LTE 386s/20 notebook PC. The unit ships with MagicSoft's *MTEZ with ExpressFax* software, and is Group III compatible. An internal V.32 modem (\$945) is available. 800-366-2983, 408-432-8030.

MicroGate has unveiled the MG144, a V.32bis, 14,400-bps modem adapter with send/receive fax capabilities for IBM PS/2s with Micro Channel architecture (\$899). The unit features V.42, V.42bis, and MNP 2 through 5 error correction and data compression for a maximum throughput rate of up to 57,600 bps. 512-345-7791.

CONTINUED FROM PAGE 64

dentally, the fish tank has been restocked. Look for the Damsel fish and Tangs.

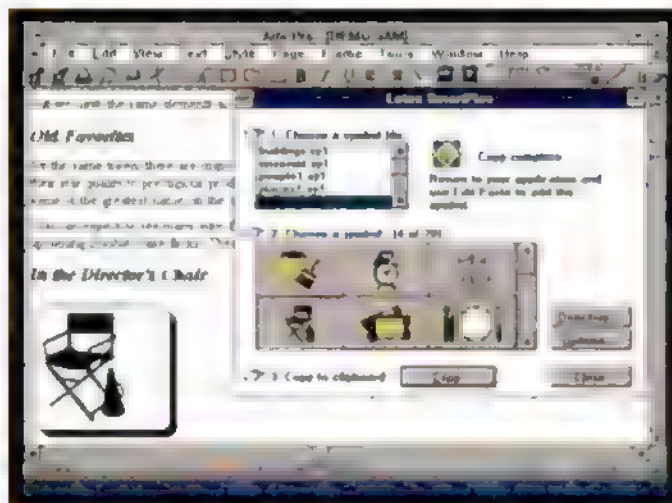
List Price: *After Dark for Windows*, Version 2.0, \$49.95. Berkeley Systems Inc., 2095 Rose St., Berkeley, CA, 94709; 510-540-5535.

CIRCLE 410 ON READER SERVICE CARD

Lotus SmartPics: Clip-Art for Every Windows Word Processor

IMPROVED Lotus's *SmartPics for Windows*, Version 1.0, provides more than 2,000 clip-art images in categories that include business professionals, medical scenes, sports metaphors, buildings, and a variety of page backgrounds. The images can be imported into any Windows word processor, spreadsheet, e-mail, or presentation package.

SmartPics has a browser (a window that can be opened over any application) that lets users scroll through, select, and apply an image to a document without exiting the application. It is also available in a network node edition and can be installed on a file server. The complete *SmartPics* library of artwork requires 11.5MB of available disk space, but users have the option during installation to install only a subset of the artwork.



Users select an image from the *SmartPics* browser, copy it to the Windows Clipboard, and paste it into a document.

List Price: *SmartPics for Windows*, Version 1.0, \$195; network edition, \$49 per node. Lotus Development Corp., Graphics Products Group, 161 First St., Cambridge, MA 02142; 617-577-8500.

CIRCLE 413 ON READER SERVICE CARD

Epson's EPL-8000: "Three-in-One" Laser Printer

NEW The 10-page-per-minute EPL-8000 laser printer from Epson supports up to three PCs without a network, and can accommodate a separate printer control language—PCL 5, Epson FX or LQ, PostScript, or HPGL

emulation—from each unit. The \$1,999 printer ships standard with two interface ports that can be assigned PCL 5 or Epson language. Optional identity cards for HPGL emulation and PostScript as well as a third PC interface are available.

Either optional language can be assigned to any available interface. With the PostScript card installed, the EPL-8000 can switch automatically between the PCL-5 and PostScript languages.

The unit has 300- by 300-dot-per-inch print resolution, 14 bitmapped and 13 scalable fonts, and 1MB RAM (expandable to 2MB on the controller). An optional memory expansion board with a maximum of 7.5MB RAM is also available.

List Price: Epson EPL-8000, \$1,999. Epson America Inc., 20770 Madrona Ave., Torrance, CA 90509-2842; 800-922-8911.

CIRCLE 412 ON READER SERVICE CARD

Two On-Line Services Bring Wall Street Home

NEW Tired of watching great investment opportunities slip away while your stockbroker vacations? There is an alternative.

MECA Software and **Fidelity Investments** have released the *Fidelity On-Line Xpress (FOX)* portfolio management software package, which lets users trade directly on-line with financial exchanges at discounted commission. It provides real-time quotes on stocks, options, mutual funds, bonds, and market indicators, and gives access to Dow Jones News/Retrieval and to research and analytical services from Standard & Poors and Telescan. *FOX* has a graphical user interface with pull-down menus and a built-in symbol look-up feature. An on-line connection to Fidelity is needed only for performing transactions or receiving information.

Reality Technologies' Reality's Smart Investor takes a four-step approach to personal investing while offering the same basic information as the Fidelity product. *Smart Investor* asks users over 60 questions in areas of acceptable risk, net worth, and financial goals to develop a profile. It then identifies the appropriate tools and services needed to choose the best investments. Like *Fidelity On-Line Xpress*, real-time quotes and on-line stock purchasing via a discount broker are provided. *Smart Investor* also issues buy/sell alerts about users' investments.

List Price: *Fidelity On-Line Xpress*, \$119.95. (Call Fidelity to order or for more information at 800-544-7272.) MECA Software Inc., 55 Wals Dr., Fairfield, CT 06430-0912; 203-256-5000.

CIRCLE 413 ON READER SERVICE CARD

List Price: *Reality's Smart Investor*, \$99.95. Reality Technologies Ltd., 3624 Market St., Philadelphia, PA 19104; 215-387-6055.

CIRCLE 414 ON READER SERVICE CARD

Bonus Package

386DX/33MHz Notebook



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AMAX FEATURES:

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Plus a Quick Charge feature of two hours.
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EVEREX			
386SX/20	\$2349	60MB	1MB
DELL			
386SX 20	\$2499	60MB	4MB
AMAX			
386SX/20	\$2349	100MB	4MB

Bonus Package

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Established in 1979, AMAX has been manufacturing systems for: Large Corporations, OEMs, Private Labels and VARs.



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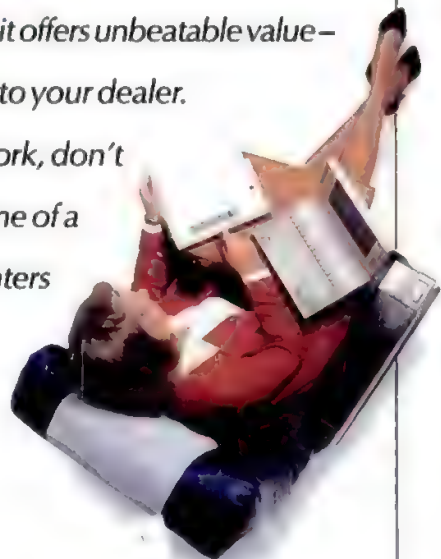
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by
Carol Levin

Read Only

Reviews of the Latest Books for the PC User

Multimedia Cookbook Serves Up Applications Made from Scratch

These days, you read a lot about multimedia. Flashy new interactive applications are revolutionizing the industry by blending text, graphics, still and motion video, and sound into a single package. But you don't hear much about how to create these modern marvels. That is the focus of *Multimedia Applications Development Using DVI Technology*, by Mark J. Bunzel and Sandra K. Morris.

At the heart of the book, you'll find an unvarnished view of what it really takes to construct a multimedia production. The authors do their best to walk you through all the aspects of development, from planning to production to publication.

One of a series of Intel/McGraw-Hill titles, *Multimedia Applications Development* takes a partisan view of Intel developments such as DVI (Digital Video Interactive)—a compression technique that matches existing CD-ROM transfer rates so that you can use CD-ROM to distribute digitized full-motion video. But the vast majority of the information is not product-specific and can be applied to a broad range of platforms and production tools.

The basic message of the book is that multimedia production is not easy or to be taken lightly. Just as a home camcorder will not turn you into a Hollywood producer, the new multimedia products available for PCs do not guarantee a professional product.

This news can be sobering. The organization chart for a "small to medium" project



lists 13 people; a large one requires 19 or more. The book also includes sample budgets (\$250,000 and up), time lines, storyboards, and flowcharts you can use for planning. The authors offer solid

advice on graphics design, motion and still photography techniques, and sound recording and mixing. They take you right through CD-ROM production and distribution. The book's thoroughness is illustrated by a chapter on copyright issues—an easily overlooked topic—and a list of resources for software, hardware, and books.

HOW DVI TECHNOLOGY SQUEEZES DATA

"At the most fundamental level, DVI technology is a set of video processors and software that give manufacturers the ability to create a digital, multimedia PC. These video processors, the i750 PB/DB (pixel processor and display processor), are high-speed, special-purpose computer chips dedicated to the task of compressing, decompressing, and displaying video. . . . A single 30-second clip of uncompressed motion video playing at 30 frames per second takes over 500 megabytes of storage. DVI compression software, working in concert with the Intel i750 video processors, allows over an hour of motion video to fit into the same size file."—*Multimedia Applications Development*, page 21.

Multimedia Applications Development offers a realistic view of what it takes to produce a quality multimedia application. If you're seriously considering such a project, you should read this book before you take another step.—*Alfred Poor*

Multimedia Applications Development Using DVI Technology, by Mark J. Bunzel and Sandra K. Morris, \$39.95, McGraw-Hill, 11 W. 19th St., New York, NY 10011; 800-262-4729. ISBN: 0-07-043297-X.

CIRCLE 483 ON READER SERVICE CARD

Handbook Promotes Healthy Computing, Offers Escape from Aches and Pains

Do your eyes burn, your neck ache, and your shoulders feel like granite when you work? *Healthy Computing: Risks and Remedies Every Computer-User Needs to Know* pinpoints some common work habits



that may be causing these symptoms. Following in the wake of recent publicity on how computer use can cause headaches, eyestrain, and more serious disabilities such as repetitive stress injuries and carpal tunnel syndrome, coauthors Dr. Ronald Harwin and Colin Haynes offer the kind of common-sense advice you may never discover on your own. For instance, leaning on your wrist or elbow all day inflicts an unnatural amount of pressure,

and sticking your head out to peer at your screen makes neck muscles work overtime. Yet many of us spend hours in such contortions.

Healthy Computing focuses on self-awareness and prevention rather than treatment. You'll find plenty of quick fixes: the proper way to rearrange your keyboard, monitor, and chair; what exercises you can do in the office; and how to make adjustments for ideal lighting and noise levels. The authors also point out some basic facts about computer equipment: Screen flicker can cause eyestrain; changing font size and screen colors can make a screen more readable; and macros can eliminate repetitive

motion. High-tech solutions such as ergonomic chairs and voice input systems are mentioned, but the focus remains on making do with what you have—a gratifying approach for the many offices that cannot buy everyone new chairs.

While its advice may not be overly innovative, *Healthy Computing* will raise your consciousness about what you and your PC are doing to your body. Its suggestions just might stop your work from being a literal pain in the neck.

—*Catherine Kunkemueller*

Healthy Computing: Risks and Remedies Every Computer-User Needs to Know

by Dr. Ronald Harwin and Colin Haynes, \$17.95, AMACOM Books, P.O. Box 319, Saranac Lake, NY 12983; 800-538-4761, 518-891-5510. ISBN 0-8144-7766-6.

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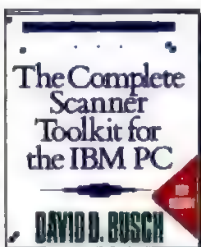
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Scanner Guide Resolves the Finer Points Of Gray-Scale and Color Techniques

Though scanner manufacturers have made their products remarkably affordable, getting the most out of them requires considerable knowledge and skill. In order to fill this need, David D. Busch has written two handbooks on the subject.

Of these, *The Complete Scanner Toolkit for the IBM PC* is by far the meatier. Everything is in there, from lucid, to-the-point coverage of file compression and controller installation to solid discussions of halftoning and color separation. The companion disk includes *ScanExpress* control software; *PRO-CR*, a shareware omnifont OCR (optical character recognition) program; and a free util-



ity to calculate screen angles and other halftone parameters.

The only conspicuously missing topic is gray-scale image editing and correction. But you will find many useful tips on selecting halftone patterns, screen angles, and the right resolution and number of gray levels for your task. There's a good discussion of printer issues, separate chapters on hand scanners and on OCR, and even a special look at nining color transparencies.

Busch's explanations are generally well written and organized, and are clear enough for neophytes as well as for more savvy users. There's a slight overemphasis on desktop

publishing applications and not enough discussion of other uses for scanners, such as capturing color images for presentations and image databases or integrating OCR and image capture in ordinary offices. But this is a compact and reasonably complete reference for any current or would-be scanner user.

That cannot be said for *The Complete Scanner Handbook for Desktop Publishing, PC Edition*. It is remarkable how two books by the same knowledgeable author can be so different in quality. Where the *Toolkit* lays out reams of useful information in an orderly fashion, the *Handbook* is under-organized and full of digressions and incomplete product information. The pair are meant to complement each other, but the *Handbook* adds little value to the *Toolkit*. (Gray-scale editing and video scanners are its only new topics.)

The *Handbook's* treatment of desktop publishing is tenuous at best. The chapters on

Ventura Publisher and Aldus PageMaker go little beyond elementary tasks that you could easily learn from the manuals, and the PageMaker chapter is based on Version 3.0, not Version 4.0. Finally, the hardware recommendations are simply off the wall in today's PC market (they actually embrace an XT-level machine as an acceptable low-end platform!). You'd be better off passing up the *Handbook* and going directly to the intelligent recommendations offered in its higher-quality sibling.—Rock Miller

The Complete Scanner Toolkit for the IBM PC

by David D. Busch, \$32.50;
ISBN: 1-55623-479-1.

The Complete Scanner Handbook for Desktop Publishing, PC Edition

by David D. Busch, \$24.95;
ISBN: 1-55623-597-6.
Business One Irwin, 1818 Ridge Rd.,
Homewood, IL 60430; 800-634-3966.

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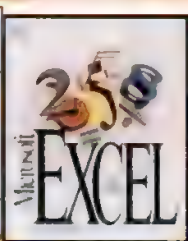
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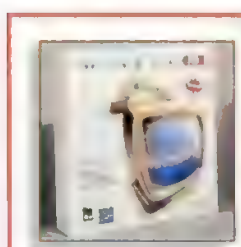
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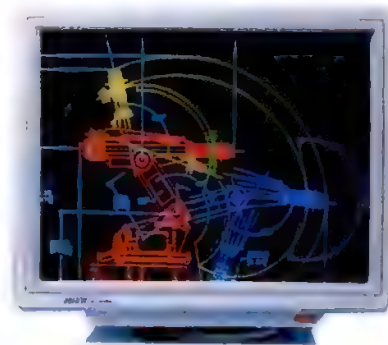
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edited by
Trudy Neuhaus

Toolkits

Reviews of the Latest Tools for the PC Programmer

QuickPak Adds Controls and Functions To VB and Resurrects BASIC Commands

Crescent Software's QuickPak Professional for Windows is a valuable extension to Microsoft Visual Basic. It offers a variety of optimized, custom user-interface controls and functions ranging from DOS access to financial calculations. QuickPak also resurrects several commands from older releases of BASIC that were left out of Visual Basic.

Custom controls are extensions to the standard controls found on the Visual Basic toolbar. QuickPak's custom controls give you new functionality at the click of a mouse button. Simply choose Add File from Visual Basic's File menu and add QPRO.DLL to your project file and the Visual Basic toolbar will automatically be extended to include the new QuickPak controls. The custom controls are improved data entry routines for both individual fields and pick lists. Self-validating field controls for date, time, currency, floating-point values, and long integer values are included.

Some custom controls are meant to replace the original controls provided by Visual Basic. An enhanced scroll bar, for example, offers smooth scrolling of text as you hold down the mouse button. Enhanced text-entry and pick-list controls are also included.

In addition to forging ahead, QuickPak also provides backward compatibility by including functions to emulate BASIC's INP, OUT, SOUND, PLAY, BLOAD, and BSAVE commands that were not incorporated into Visual Basic. These come in handy if you are porting your current BASIC programs to Visual Basic and have used these commands in those

programs. The PEEK and POKE commands are also available, but, as the manual warns, use these with caution: Windows can and does move items in memory without letting you know.

QuickPak consists of two dynamic link libraries (DLLs): QPRO.DLL and QPRO-RUN.DLL. To produce quick, efficient code, most QuickPak routines are written in assembly language. Source code is provided for all of QuickPak's controls, functions, and demos. The code is clearly commented and con-

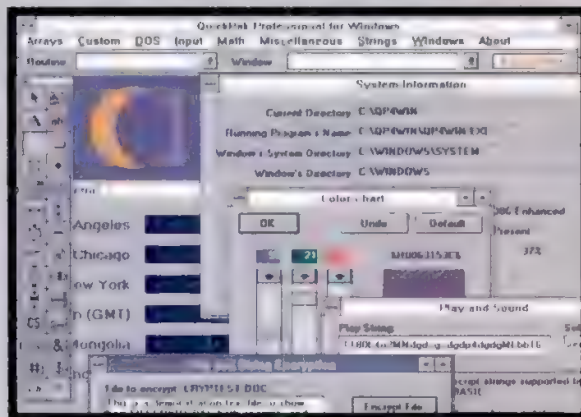
examples of how to call the Windows API from Visual Basic. For example, you may want to present a list of windows and allow the user to switch between them. Visual Basic limits a program's access to Windows objects to the handle of the current form. QuickPak's EnumWins and ControlHWND functions, on the other hand, give you access to the handles of all active windows and controls, respectively. The documentation for these functions refers you to sample code that demonstrates how to use Windows API calls to manipulate these objects.

Crescent Software encourages advanced Windows programmers to extend QuickPak's DLLs. To this end, the company provides

write your own. You can also use Borland's Turbo Pascal for Windows or Borland C++ for this purpose. Unfortunately, creating or enhancing a DLL for Visual Basic isn't easy. Crescent provides a free help line (open 9:00 to 5:00 E.S.T.). If your needs are more complex, however, the company's support staff will help you build a custom DLL for a nominal fee. You simply provide them with a list of QuickPak routines and controls, and they will create a DLL that contains only the routines you need for your application.

At press time, Crescent said that an update to QuickPak Professional for Windows will be out shortly. The new release will support a color picture box with 24-bit graphics support in .PCX and .BMP formats; .TIF, .GIF, and Windows Metafile formats will be in a subsequent release. Visual Basic currently supports only the 16-color .BMP format. Crescent is also working on BitBlt manipulation routines for fast low-level animation and is custom-designing button controls that will let you alter an image's size, shape, and bevel, and text font and position.

If you are new to Visual Basic, you will find that QuickPak Professional for Windows will reduce your learning curve. If you are an advanced Visual Basic programmer, you will find QuickPak helpful in overcoming some of Visual Basic's limitations and giving you greater control. —Bradley G. Epranian ■



This screen shows the Visual Basic toolbar extended with the QuickPak Professional for Windows custom controls. Using the menu structure, you can bring up dialog boxes to obtain system information, determine screen colors, implement sound, and encrypt files and strings, among other things.

tains notes and hints on how to tailor the source code to your own needs.

The documentation for QuickPak Professional for Windows contains abundant references to sample code. There are even

a Make file and all source code. Armed with this source code, the Windows Software Development Kit (SDK), and Microsoft's Control Development Kit (CDK), you can extend QuickPak's functions and custom controls or even

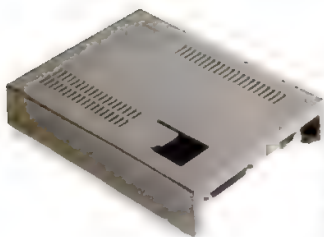
QuickPak Professional for Windows, Version 1.0

List price: \$199. **Requires:** 286-based PC or better, 2MB RAM, DOS 3.1 or later, Microsoft Windows 3.0, Visual Basic 1.0. Crescent Software, 32 Seventy Acres, West Redding, CT 06896; 203-438-5300.

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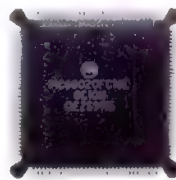


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Michael J. Miller



Move Over Macintosh

Apple's Mac used to be the only graphics game in town. Well, the PC as a graphics station is coming on strong.

Not too long ago, if you wanted to produce sophisticated graphics, you needed a Macintosh. But thanks to some surprisingly powerful new Windows applications, the PC is emerging as quite a good platform for high-end graphics.

The PC has long been a credible platform for midlevel desktop publishing with packages such as *Aldus PageMaker* and *Ventura Publisher*. Still, in many respects there hasn't been a wealth of associated tools for creating illustrations or modifying those generated within the Macintosh graphics community.

Things are changing quite rapidly, though. Several years ago, powerful vector-based PC illustration packages such as *CorelDRAW* and *Micrografx's Designer* proved that you could indeed get fine control of drawings with tools such as automatic tracing and Bezier curve drawing. Those tools have now

been joined by *Aldus FreeHand for Windows* and the soon-to-be-released *Adobe Illustrator 4.0*—fully powered PC versions of the most popular Mac illustration programs.

It doesn't end with illustration software, either. Another category of sophisticated graphics packages on the PC platform to attain critical mass is image editing. These packages let you take a scanned image and modify it electronically. The strongest candidates on the PC side include *Aldus's PhotoStyler*, *Micrografx's Picture Publisher*, and *Zsoft's PhotoFinish*.

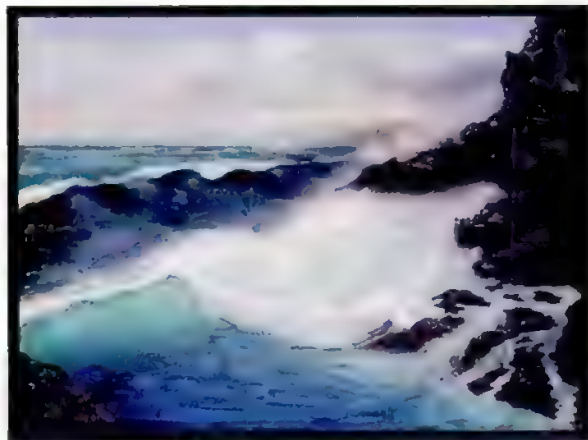
PhotoFinish is an excellent representative of what you can accomplish with these editing packages. You can select a part of the image, then enhance its different parts by changing the way the image responds to different lighting curves. By this I mean that you look at how light and darkness is apportioned throughout the image, and then change that distribution to produce the best-looking image possible. In effect, you are lightening or darkening different parts of the image, or opening up the image's midlevel ranges and halftones. You can do this on a widespread basis or use the *Brighten Paintbrush* tool to brighten selected

regions—just as you would otherwise draw over them. Other tools let you smooth or smudge various lines, shapes, shades, and colors or sharpen the entire image.

Using some of the more imaginative tools, you can create a "posterized" look—dramatically accentuating the image by heavily contrasting its dark and light areas. Alternatively, you can completely change the background. Use the "clone" command to put a different picture into the background. Take a picture of yourself at the office and make it appear that you were in Tahiti. Or you can fill the background with a particular tile pattern to make images in the foreground stand out vividly. It's a lot of fun; just don't get carried away.

PhotoFinish really seems designed to be used in conjunction with a gray-scale scanner, although it supports color scanning as well. More than any of the competition, it's best suited for nonprofessionals. *Micrografx's Picture Publisher* utilizes many of the same concepts, but seems geared much more toward working with color images and photographs.

Picture Publisher is especially good at selecting "masks"—the part of the image you are either working with or excluding from your



Fractal Design Painter's many tools and styles let artists render images previously impossible on any PC.

fine-tuning. You select the mask, then choose from various tools that let you change the hue and saturation of your colors or vary the brightness and contrast of the image.

By using these various tools together, you can create all sorts of effects. For instance, it's

Michael J. Miller

fairly simple to take a red shirt and make it blue. This works better than in a pure painting or drawing program because it preserves the intensity of color, making it look lifelike. By changing the hue and saturation, you can easily turn a photograph into a color poster. You can change the

background completely, combine multiple pictures, and basically do almost anything you can think of to your picture. You may never trust another photo again.

While none of these programs are simple to use, even someone who can't draw—like me—can create really wonderful effects. Nor are they replacements for illustration packages; they don't have nearly the flexibility or number of drawing tools that you would find in a package

like *Designer* or *CorelDRAW*.

For creating an image from scratch, you'll probably want to use an illustration package. But a fabulous new bitmap paint program called *Fractal Design Painter* applies many of the same concepts as image editors—and then some—to the painting metaphor.

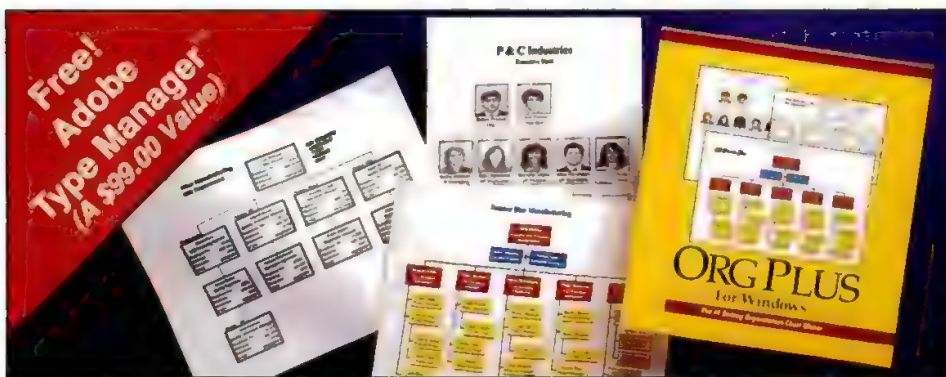
Developed by Fractal Design Corp., a small start-up company in Pacific Grove, Calif., *Painter* has most of the features you would expect in a painting program, including various brushes and colors that let you paint individual pixels on-screen. What sets *Painter* apart is the flexibility of the tools. This is the first program I've seen that was really designed to mimic the tools that a "real" painter would use.

You can choose from all sorts of variations of pencils, brushes, and pen-and-ink tools, as well as chalk, charcoal, felt pens, crayons, and an airbrush. Some of the more unusual tools include a "van Gogh" brush for multicolored strokes and a "dirty felt marker," which picks up colors as you drag through them.

Painter also supports Wacom's line of pressure-sensitive digitizing tablets. When you use one of these tablets, *Painter's* drawing tools can determine how hard you are pressing and respond accordingly. For instance, crayons mash down quite differently than do oil brushes. But *Painter* doesn't stop there. You choose the kind of paper to draw on, including the color and the grain of the paper. It even has a "water drop" feature to smear your paint. You can clone a complete image, which is more than just making an exact copy. Instead, cloning lets you create a copy and then place it using a different style or medium. Select a different kind of brush, and it will look as if the image were created in pencil (as in a *Wall Street Journal* sketch), or in chalk, or in the style of van Gogh.

In short, *Fractal Design Painter* really captures the feeling of working on a canvas, combined with all the power and advantages of a computer—such as easy editing and copying.

Packages like *Painter* show that PC graphics are headed in the right direction. High-end graphics on the PC are still not as smooth as we want them to be, and getting all the software and hardware (tablets, scanners, true-color video boards) to work together is more difficult than it should be. It is getting better, though, and all of these tools show the PC's tremendous potential for becoming a great tool for graphics artists. So move over, Macintosh. ■



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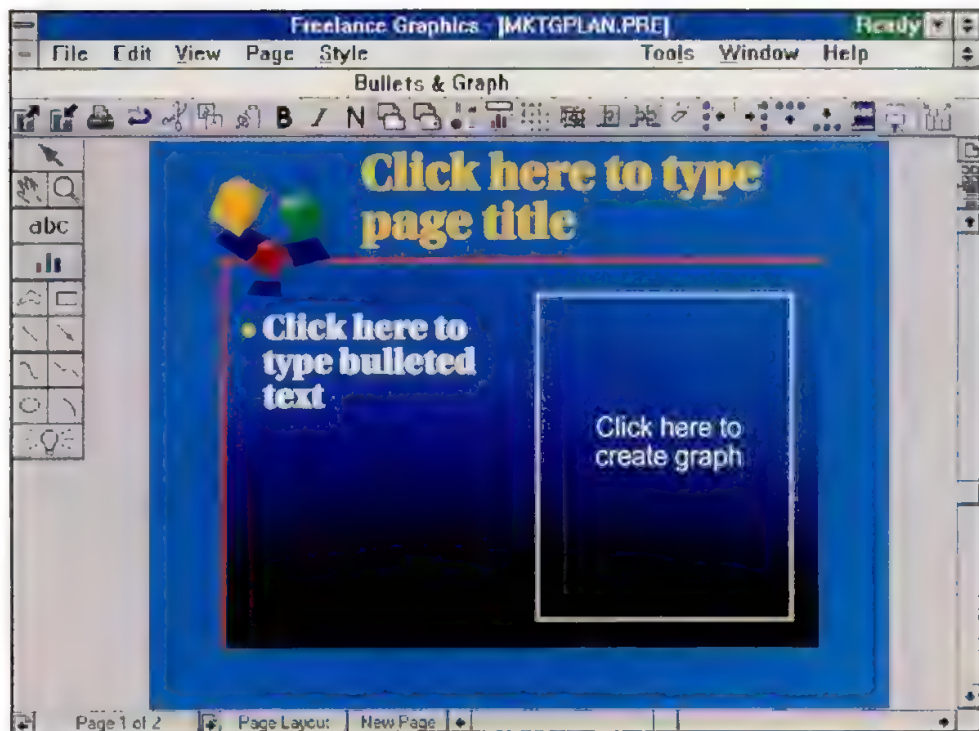
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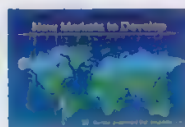
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Bill Machrone



The Great Windows Software Scandal

It's time to beat up on the Windows application vendors. They have beaten up on us long enough.

One thing you'll never lack for in *PC Magazine* is an opinion. Sometimes it seems as if the sum of the work of all our columnists, authors, editors, and contributing editors is one giant cathartic outpouring of analysis, commentary, and criticism. That's not all we do. We also take up causes. One of our earliest was copy protection. Back in the bad old days, a significant amount of software was copy protected, and the methods, as often as not, were flawed, intrusive, limiting, and occasionally even destructive. Inspired by leaders in the user-group community, we took up the challenge. *PC Magazine* brought the issue to a head

by simply denying Editors' Choice status to any product that was copy protected. Software publishers complained, but ultimately they caved in. And their business grew.

PC Magazine was the first to declare the 286 to be brain-damaged, and we decided that even if we ever reviewed another 286-based machine (we did one more roundup), we would not select an Editors' Choice.

This time the readers complained. We were pushing the state of the art too hard, too fast. We were shills for the manufacturers. Hey, the vendors didn't care. They made a buck on whatever you bought. Maybe their margins were a little higher on the 386 boxes, but the volume was lower.

John C. Dvorak has excoriated more dumb ideas than I can count, usually to a chorus of boos and hisses. History usually proves him right. In recent columns Will Zachmann and I have both advanced new causes. I've declared the death of the 386, saying that the 486 has the performance, the growth path, and the architecture to be our primary consideration when it's time to buy new hardware. Will has called for the end of 2,400-bit-per-second modems, telling us that it's high time to get on with 9,600- and 14,400-bps communications. We're both right; we can tell by the amount of hate mail we're getting.

This time we bring our guns to bear on Windows programs, and I'll bet that I won't hear a single dissenting voice. Some of these programs are like viruses. Once they're on

your system, you may never get them off.

Have you ever tried to uninstall a Windows program? If you haven't, you're in for an experience, but not a pleasant one. With DOS, you don't think too much about removing an application. You just DEL SNAFFLE, then RD SNAFFLE, and it's gone. If any subdirectories lurked out there, you'd be told about them and could zap them, too. Most DOS shells allow you to remove a directory and all the subdirectories in one shot, or you can use the NUKE utility available on PC MagNet.

Life is not so simple once you've brought Windows into the scene. When you install a Windows app, it copies its files to the hard disk, of course, but not in any consistent way. It may put them in a first-tier directory, or it may build a subdirectory under \WINDOWS. Either is likely to be replete with subdirectories, as with any other application. Then come the .INI (initialization) files. The program adds a section for itself in WIN.INI; it may add to or modify SYSTEM.INI, and may create an INI file for its own use. It builds resource files, such as .ICO and .DLL (icons and dynamically linked libraries), which it may install in its own subdirectory or in \WINDOWS. There are no installation standards for programs to follow. Worse, there is no standard way to uninstall software—to get rid of stuff once you're through with it.



Okay, I'll grant you that we try a lot more software around here than your typical user does. But I'll guarantee that even the most mundane Windows user will eventually encounter some undesirable conflicts or interactions among applications. The poor soul will

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CIRCLE 111 ON READER SERVICE CARD

Bill Machrone

be at a loss for a way to get rid of the offending software short of wiping the hard disk and reinstalling Windows. Don't laugh; I've resorted to this measure.

While I was roughing out this column, executive editor Robin Raskin was having trouble making the new version of Windows work at all on her home machine. She sent me the following message:

"Let me tell you about my night with Windows 3.1. It's 4 hours later and I've shrunk my WIN.INI in half by deleting all sorts of soft fonts that I must have installed years ago. I still can only run Windows 3.1 in Standard mode (perhaps it's my swap file, but it may be my aging BIOS?), and now I can play MIDI but not .WAV files with my sound board. In a word, I'm disgusted. And my family isn't too pleased with my 'gimme-15-minutes-to-install-the-new-version-of-Windows-and-then-I'll-cook-dinner' routine. Win 3.1 is fine and dandy on my minimalist system at work, but at home, where I'm a real user with a real history of Windows apps, Windows is maddening!"

If she'd been able to uninstall some of those old programs, the upgrade would probably have gone much more smoothly and she would at least have been able to isolate the interactions.

A MESSAGE TO THE INDUSTRY

Here are my guidelines for a proper Windows application uninstall procedure:

1. Leave WIN.INI and SYSTEM.INI the way you found them. Most conflicts can be traced to these two files. And those files grow endlessly as you install new programs, slowing Windows' start-up time and generally becoming unreadable.

2. Remove all the files you installed. The original install disks should not be necessary for this process.

3. Optionally remove data files. The uninstall should be able to remove all data files that the program created, but only at the user's request.

4. Remove all icons and program groups you've created. Clean up the screen. Be smart enough not to delete something in a program group that you didn't create.

Can you do that for us, Windows vendors? We'd sure appreciate it. And who knows? There might be an Editors' Choice award in it for you. ■

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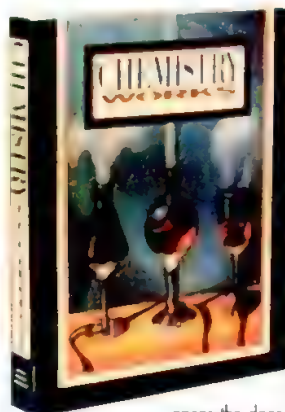
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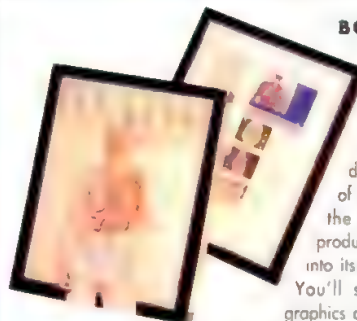


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What Buyers Say					
How long does it take to get a support representative on the phone? (most frequent answer)	1 hr & less	1 hr & less	1 hr & less	1 hr & less	1 hr & less
Technical competence of support representative (10 is best)	10	10	10	10	10
How long does it take for the vendor to solve your problem? (most frequent response)	1 hr & less	1 hr & less	1 hr & less	1 hr & less	1 hr & less
If your job depended on it, would you recommend buying more PCs from this firm?	Yes	Yes	Yes	Yes	Yes
Overall rating for service and support (10 is best)	10	10	10	10	10

NOTES: Customer satisfaction results were compiled from PC Week's survey of PC managers whose organizations have purchased mail-order PCs. 15 customers of each vendor were surveyed.

Prices and specifications shown were supplied by vendors, each of which was asked for a quote on its lowest-priced 25MHz 386 machine with 4M bytes of RAM, dual floppies, a 100M-byte hard drive, 14-inch Super VGA monitor, keyboard, mouse, Windows and DOS 5.0. Any changes to the configuration or no-cost options are shown. Prices were gathered by calls to each vendor between Oct. 3 and Oct 14, and include tax and shipping charges.

*System is upgradable.

Chart Reprint from October 21, 1991 issue of PC Week. Reprinted by permission.

ZEOS Rates #1

There's no reason to buy anything else.

800-423-5891

John C. Dvorak



A Proposal: BIOS/2

PC architecture has become a mine field of confused standards. Can Microsoft (or anyone) fix it?

Apple stock is up and Mac sales continue to grow, but PC adherents completely shrug off the Apple threat. Most assume that Windows will kill off the Mac, missing the point that the single-source hardware design of the Mac makes for a better integration of hardware and software and thus a better computer. Fact is, PC architecture is out of control. Something must be done, now!

Take SCSI. (Please!) The Mac has had SCSI (the small computer system interface) integrated within its OS and hardware for nearly a decade. SCSI is a disaster on the PC due to BIOS conflicts and other anomalies. Microsoft has avoided incorporating SCSI into DOS and Windows because it doesn't want to hear squawks from vendors who have marketed thousands of makeshift SCSI interfaces for CD-ROM drives, hard disks, and other devices.

It's no coincidence that Microsoft keeps trying to establish rigid hardware standards in a hopeless attempt to bring PC architecture under control—like its MPC (Multimedia PC) standard, for example. Here's the real solution: Microsoft is the only company in a position to do something more than pontificate about standards. It should write a BIOS (let's call it BIOS/2) for the PC, make it public-domain, and then make its OS of the future require BIOS/2. Microsoft should also sell a replacement version of BIOS/2 for existing PCs.

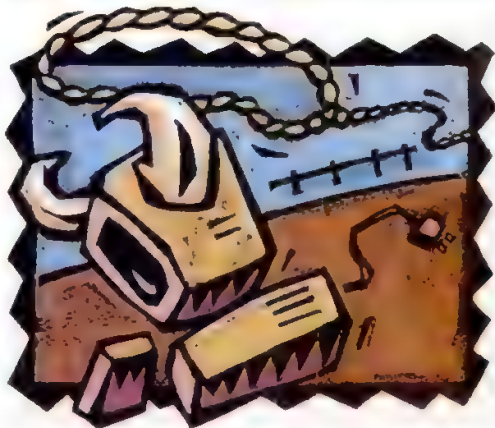
The question remains: Can Microsoft design a real BIOS? Microsoft is an opportunist whose *modus operandi* is to buy other people's code and have its 10,000 drones tweak that into a commercial product. Well, there are a slew of BIOS design companies that Microsoft should have purchased, especially when they were down. Phoenix comes to mind. Phoenix was down for the count a couple of years back after it threw its resources into a daft plan of Sun Microsystems' to take advantage of a non-existent opportunity: making the BIOS for all of the would-be clones of the Sun Workstation. The plan failed; Phoenix was ripe for the picking, but Microsoft did not bite.

Microsoft, unfortunately, has been burned in the past when it dabbled in the truly grandi-

ose. Its failed home machine (using the MSX standard) and its effort to penetrate the Japanese market were both attempts to create something from nothing. That's a far cry from grabbing the horns of a runaway bull to control its direction. Then again, Microsoft has shown little foresight when it comes to hardware. It was an agent when the original OS/2 was designed to run on 286 machines (when it was clear that the 286 was an interim chip of no consequence), and while it blames IBM for this stupidity, Microsoft did it again—basing its first MPC standard on the 286!

While Microsoft should be responsible for the new standardization of the PC architecture, it may not have the ability to do the chore right. The only other company that might be able to manage it is Novell, which could then incorporate networking into the new BIOS. But it's unlikely that Novell would release such a product into the public domain. And Microsoft would resist writing DOS and Windows to accommodate Novell.

I suppose the doomed ACE consortium should be doing this, but it's unlikely they'd accomplish much more than EISA-II. The only solution is for the half-dozen important BIOS design teams to form an alliance. Something that will not be perceived as antitrust. Microsoft should help them with money and other-



wise stay away from them. Once a new standard PC architecture is confirmed incorporating SCSI, ESDI, and whatever else, then a plug-and-play machine in the PC arena will become a reality and the threat to Apple will be genuine. Until then, Apple has the advantage with everything except price. ■

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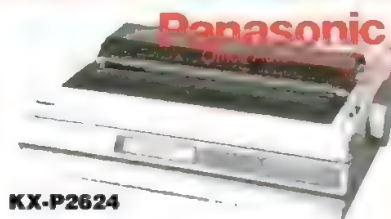


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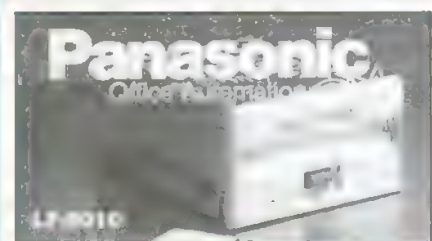
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Inside Track

IBM has been in the news more than ever. *The New York Times* reported that IBM was chatting with Sun Microsystems about Taligent (the Apple-IBM joint venture), hinting that Sun should join. IBM **vehemently denied** the rumor. The reporter had the information on good authority from multiple sources, and the denial baffled him. I was **baffled** as to **why IBM** would even be talking to Sun in the first place. The possibility exists that IBM is talking to Sun about more than just Taligent, hence the need for secrecy. Is a **buyout of Sun** in the works? Sun is known to be an enemy of Apple; maybe IBM just went off half-cocked and was embarrassed by the exposure. David Harrah, a spokesman for IBM at its Armonk headquarters, said that he was not aware of any talks between Taligent and any other companies. Gee, does that mean Taligent doesn't talk to Apple or IBM either?

Drawing the Battle Lines: We have a consortium called ACE to **attack** the RS/6000 and Sun workstations. Sun says it will do an OS for the Intel chips attacking Microsoft and IBM. We have Taligent **attacking** Sun and Microsoft. MIPS merging with Silicon Graphics to **attack** Sun and the RS/6000, and Apollo joining HP to **attack** everyone! I hope they all have fun.

Meanwhile, IBM's been announcing joint ventures with everyone under the Sun (pun intended). Most of the deals involved a slew of new disk drives it is making. IBM will OEM new 60MB and 120MB 2.5-inch disk drives, rewritable optical disk drives, mag tape subsystems, and a 1.2-gigabyte 3.5-inch disk drive that uses **magneto-resistive head** technology invented at IBM San Jose.

While it sells drives to customers with its own name on the product, **IBM will sell** its own product directly to customers **under an assumed** name, too! According to a number of reports, IBM plans to sell a low-end line of computers in Europe under some yet-to-be-determined new name. Perhaps it doesn't want to be associated with **cheap products**. Maybe it fears that the anti-IBM sentiment prevalent in some parts of Europe would hurt sales. I think the fun thing to do is figure out what kind of **wacky name** IBM would choose for such a venture. How about calling it the Akers Computer Co.? How about symbolizing low prices by referring to a lizard's stomach—low to the ground (low prices, get it?). That name could be the **Belly-Akers Computer Co.!** (No letters, please!)

DEC has
discovered direct
marketing, but its
ad showing a
color screen on a
\$2,000 laptop will
create more
problems than
sales. You can't
get a color laptop
for \$2,000!

Since I Mentioned ACE Dept.: Digital Equipment Corporation (DEC), if you haven't noticed, has discovered direct

marketing. Its ads for PC-compatibles are all over the place. Hopefully it will discover that putting a color picture on the screen of a \$2,000 laptop will create more problems than sales. Maybe people will *know* that you can't get a color laptop for \$2,000 and just see the concept as "art." Ahem. Less artsy and **more interesting** is the huge 230-page catalog that DEC is now distributing to help

push its RISC machines. Very nice. If you're interested in ACE, you should get a copy of this **fat catalog** of software. Call 800-344-4825 (phone), 800-234-2298 (fax), or 800-234-1998 (BBS). The catalog is called "DEC Direct—RISC. Systems and Applications."

Write This Down Dept.: Next time there's a virus panic and you need a virus scanner fast, call McAfee and Associates to get its excellent **shareware virus detection** scanner. You can download it from the MacAfee BBS. Call 408-988-3832 (phone), 408-988-4004 (BBS), or 408-988-5190 (9,600-bps BBS).

Those Germans and That Big Show Dept.: It's called CeBit and it's a **huge** electronics show in Hannover, Germany. It's bigger than Comdex and it's as much of a hassle. This year **people were goof-erized** over the new color copier from Canon. All of us will probably have a version of it in the years ahead. (How did Canon take the copier market from Xerox so easily, anyway? Answer: It wasn't easy; it took hard work!) It's a 400-dot-

per-inch unit that takes 90 seconds to turn out a full color copy using the newest Canon Bubble Jet technology. It can be linked to a PC to become a color printer *and* a scanner. **It's a killer.** Expect one on your desk within a few years.

Free Collector's Item Dept.: XTree Corp. is always looking for a publicity stunt to get attention for its fine products. I use *XTree ProGold* as my hard disk manager and have yet to find anything better, so I don't mind giving XTree a plug for this latest ploy. To publicize its *AllSafe* (access protection and encryption) and *VirusSafe* (virus detection and prevention) programs, XTree published a **screwy comic book** called *SWAT—Software Warriors Against Tampering*. At eight meager pages it's not in the league with the old Disney comics commissioned decades ago by the Atomic Energy Commission to promote nuclear power. Still, it's collectible and free. Call Tracy Immel at 805-541-0604 to get one. ■

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Jim Seymour



Breaking Through The Clock-Doubler Fog

Intel's new speed-doubling CPU chips need a bit of explanation, but underneath the confusion is one of the best upgrade options ever for users.

After months of rumors, denials, misinformation, and confusion, Intel is finally starting to ship its "speed-doubling" chips. Based on my experience with early units, these promise to be among the smartest, most cost-effective upgrades yet for PC users eager to wring more speed out of their existing boxes.

But Intel's dual marketing paths for these chips, and the little twists and turns along the way, make it essential to buy the right unit. That choice may not always be self-evident.

Whichever path you follow, the advantages of upgrading with these chips are immediate and obvious: Your PC runs a lot faster. These chips run internally at exactly twice the speed of the 486 chips they effectively replace. No "clock-doubling" actually takes place (that is a misnomer introduced by the press). Externally, they run at the same speed as the 486 around which the machine was built. That should assure

compatibility with the other components in the original chassis.

As with all CPU-only upgrades, adding one of Intel's speed-doubler chips only improves the machine's actual computing speed. Supporting processes—from moving data to and from the hard disk, to any data transfer across the machine's I/O expansion bus, to screen redraws—aren't affected by the change, and those can be real bottlenecks. That's why you'll rarely get as much improvement in overall system throughput (a term I use loosely here to mean the speed of the whole computing process) as the speed doubling of these new CPUs would seem to promise.

But the gain is real and noticeable, especially in computation-intensive applications. Don't look for a 100 percent speed increase, but you can expect maybe a 50 to 60 percent real increase, which isn't bad at all for the relatively modest cost of the upgrade.

Intel sells these chips in two ways. One form, a retail-only post-sale enhancement product, is called the OverDrive. This is a do-it-yourself, plug-and-play upgrade chip for

owners of PCs built around the Intel 486SX chip (running at any speed).

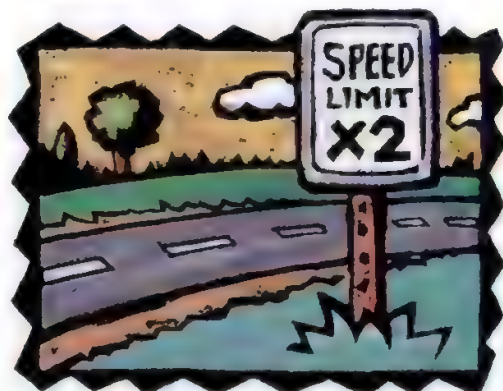
When it began sampling the 486SX to PC makers, Intel strongly encouraged them to add a "processor enhancement" socket on every 486SX PC's motherboard, right next to the CPU itself. Intel promised that interesting things would be coming along for that socket, and now the company has delivered on the promise.

SHIFTING INTO OVERDRIVE

If you own a 486SX, you should give serious consideration to upgrading with an OverDrive chip. Though I was worried at first about compatibility and ensuing support difficulties, my experience has persuaded me that this is a problem-free swap.

As I write this column, Intel hasn't released exact prices for OverDrive chips, but you can expect list prices to be between about \$500 and \$700, with actual street prices 25 to 30 percent lower.

Intel is also selling its speed-doubler chips as an OEM product called 486 DX2 chips. These, as you'd guess from the name, are intended to replace standard 486DX chips. They work to the advantage of both PC makers and PC buyers.



For the former, the 486 DX2 allows vendors to add a new machine to their lines with virtually no effort and little additional cost. Intel designed the DX2s to drop into any 486DX system presently in production—with a substantial net increase in operating speed.

Whether that change is as easy as it sounds depends on the PC maker's design of its origi-

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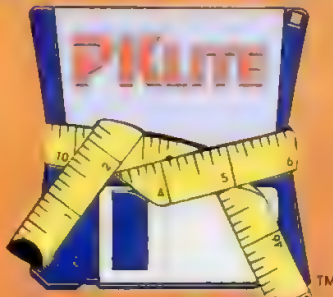
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PC-5/92

Jim Seymour

nal 486DX system. Many PC makers still use timing loops in their BIOSes, despite advice to the contrary from Intel. If a vendor has built sensitive timing loops into the BIOS on an existing 486DX, then a BIOS rewrite will also be necessary. That shouldn't be hard—it depends on why the timing loops are there in the first place, and loops have been used to cover a multitude of sins—but if the BIOS is otherwise relatively clean, then the problem isn't difficult to solve. So for vendors, the DX2 offers an instant upgrade for their lines, with little or no additional cost but with the potential for charging us more money for the finished product.

For the owners of existing 486DX PCs, the news is good, too, but once again the ease of upgrading will depend on the integrity of the system manufacturer's engineering. It's just as easy for us to drop a new 486 DX2 into an existing 486DX machine as it is for vendors. Unfortunately, we face the same timing-loop problems they do. The ease of upgrading also depends on how the original 486DX chip was installed in the machine.

If the chip is socketed, not soldered, and if the BIOS is clean and free from timing loops keyed to the speed of the existing 486 chip, then it's just a matter of chip swapping. If the vendor mounted the 486DX chip on a plug-in card that also carries the machine's BIOS chip, even BIOS upgrades can be plug-and-play: Just replace that daughterboard with a new one carrying both the new 486 DX2 CPU and the new BIOS.

Some vendors will be offering upgrades by mail, sending you the part (or parts) to install yourself. Others may ask you to ship the machine back to them, so they can install the new parts and put the upgraded machine through a testing cycle at the factory—or at least to send it to an approved service facility.

Pricing will depend on the complexity of the installation but should range from \$750 to \$900 net.

The first 486SX machines didn't make much sense; 33-MHz 386s typically outperformed them and cost less. The OverDrive chips now make 486SXs a respectable buy. And buyers of 486DX machines clearly want all the performance they can get; 486 DX2s deliver a serious increase in speed at a remarkably moderate price.

Nice job, Intel.

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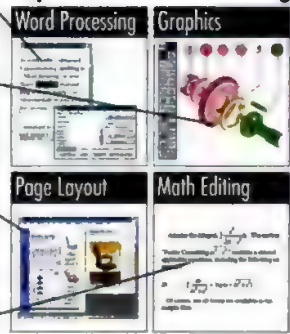
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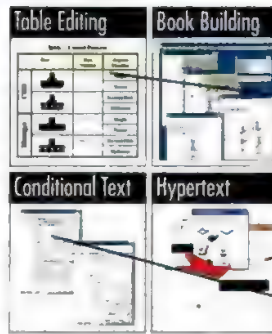
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William F. Zachmann



Let's Bury 2,400 bps

The price is right, the features are irresistible; it's time to turn 2,400-bps modems into antiques and adopt a faster solution.

A few issues back, Bill Machrone argued for the "death" of the 386. It sounded good to me. An even better idea is to declare 2,400-bps modems dead. Buying a 2,400-bps modem today is as penny wise and pound foolish as buying a 286-based PC.

As with PC purchases, the obvious (but superficial) argument for 2,400-bps modems is low cost. Even top name-brand modems have fallen to the range of \$100 to \$150; lesser-known brands sell for half that.

By contrast, prices of 9,600- and 14,400-bps modems are much higher but are dropping rapidly. The new V.32bis/V.42/V.42bis 14,400-bps modems, complete with high-speed fax capabilities (such as Intel's recently introduced Satis FAXtion Modem/400), are available with list prices under \$500.

Still, these newer modems cost more. What do you get for your dollar? Plenty, especially when you look at the value delivered over the life of the modem.

Remember that from a mechanical standpoint, your modem will be with you over the long haul. A modem is an all-electronic device, with no moving parts; mechanical parts are the most vulnerable points of failure in personal computer systems. The 300-bps Hayes Smartmodem I bought in 1982 is painfully slow, but it still works just fine.

Of course, many on-line services don't yet fully support the newer high-speed modems. Those that do often charge a premium. Wider support is on the way, though, and access-charge premiums will eventually disappear, too. And even though standards for high-speed modems have only begun to fall into place, there are plenty of modems available with 14.4-kilobit-per-second V.32bis data transmission, V.42 error detection and correction, and V.42bis data compression.

These standards create a foundation that will soon make 2,400-bps obsolete. The bottom line is that the new V.32bis/V.42/V.42bis modems we buy today will still be very close to the best we can get until past the middle of this decade.

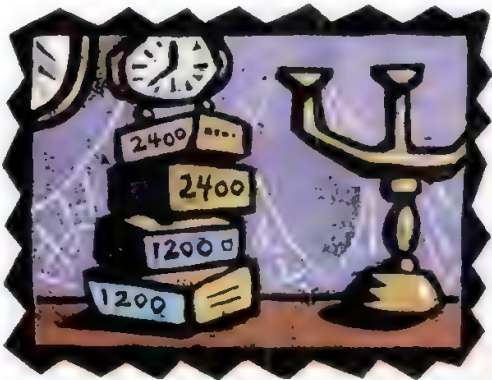
The V.FAST 19.2-Kbps standard proposed by the CCITT and now under development is

still a long way from appearing in any commercial product. Even then, it will provide only modest performance improvement over V32bis's 14.4 Kbps. Further, since 14.4 Kbps already pushes the limits of existing phone lines, it remains to be seen whether V.FAST can be implemented in an affordable manner.

Nor is it likely that the capabilities of the Integrated Service Digital Network (ISDN) will be widely available soon. ISDN is supposed to replace analog phone lines and make modems obsolete. But the cost and time to build a transmission infrastructure for ISDN make it likely that most of us will still use modems on analog phone lines well into the late 1990s.

Today, laptop computers also present some sticky problems. Laptops are precisely where high-speed 14.4-Kbps modems are most needed but still most difficult to obtain. Lack of a common standard for modem add-in cards, as well as special requirements for miniaturization and low power consumption, means that most laptops are still offered only with 2,400-bps modems.

As computer buyers vote with their pocketbooks and demand laptops with faster modems, things should change. Late this year or early next year we will probably see a wide selection of 9.6-Kbps and (even better) 14.4-Kbps modems on laptop computers.



We ought to make 14.4-Kbps V.32bis/V.42/V.42bis modems our default choice for new purchases. They're right for now, and for well into the future. We'll be using them long after their slow 2,400-bps cousins are collecting dust on the attic shelf. ■

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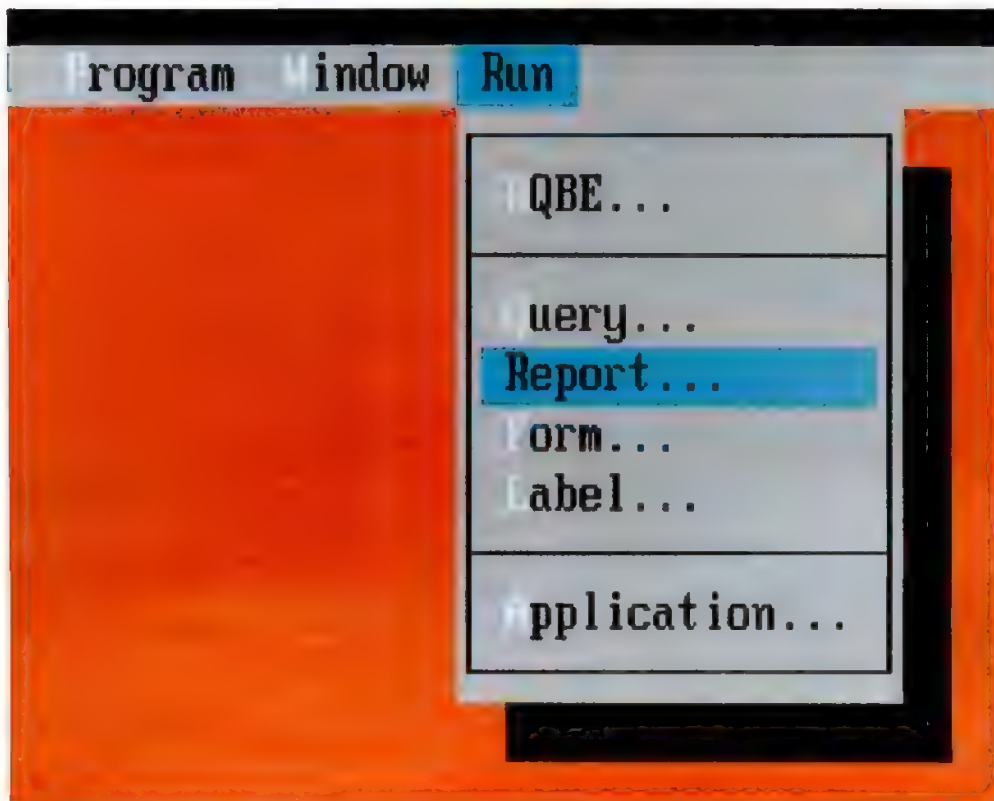


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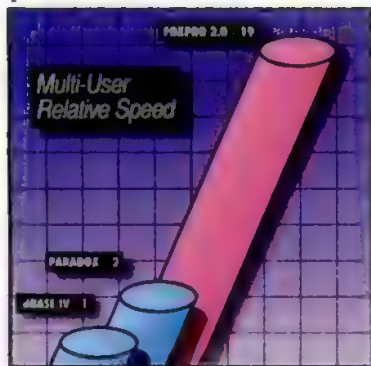
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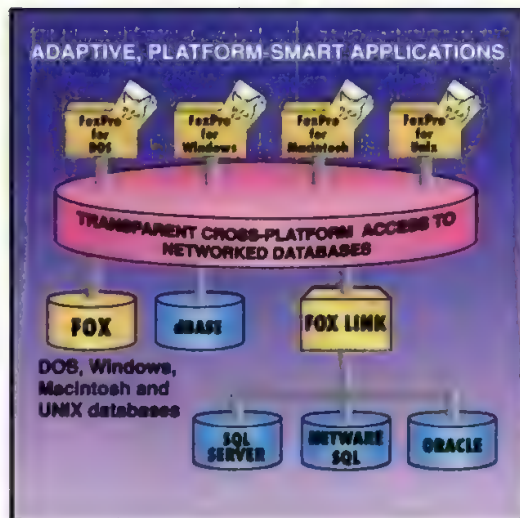
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SERVICE AND RELIABILITY 1992

How Reliable Is Your PC Vendor?



More than 8,500 readers told PC Magazine what they think of 35 of the top PC manufacturers in our 1992 Service and Reliability Survey. Our respondents rated the reliability, servicing, support, and repair of their systems, and told us whether they would buy from the same company in the future. by Michael J. Miller

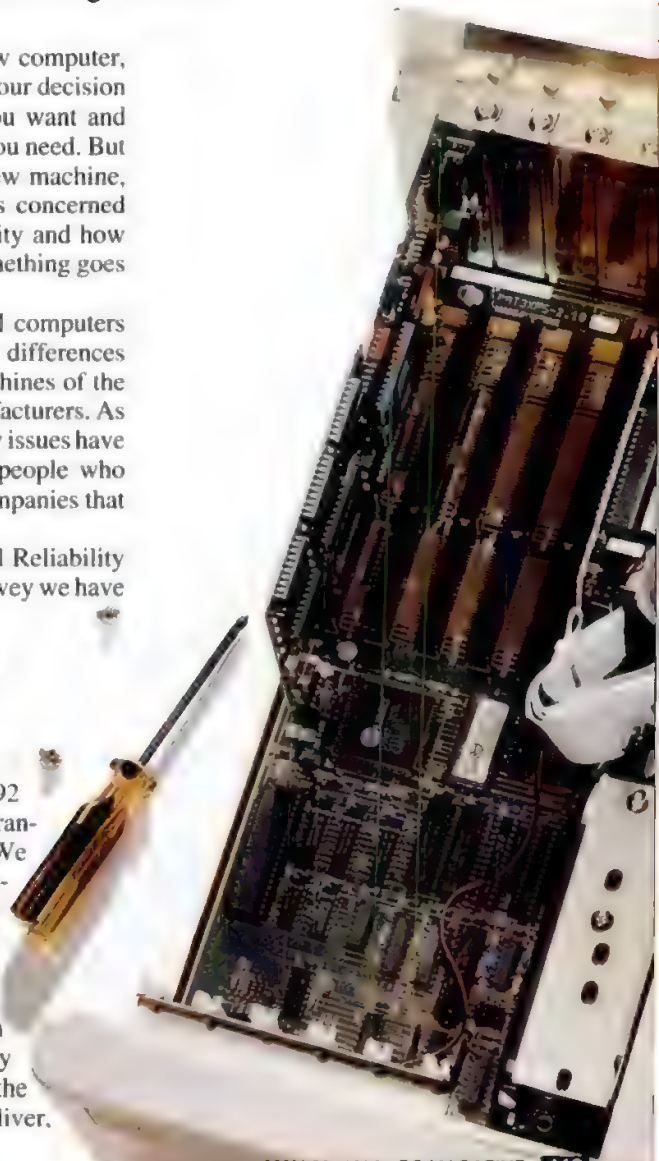
IN THIS REVIEW

- Acer America Corp.
- Advanced Logic Research Inc.
- AST Research Inc.
- AT&T Computer Systems
- Austin Computer Systems Inc.
- Bondwell Industrial Co. Inc.
- Compaq Computer Corp.
- CompuAdd Computer Corp.
- Dell Computer Corp.
- Digital Equipment Corp.
- DTK Computer Corp.
- Epson America Inc.
- Everex Systems Inc.
- Gateway 2000
- Hewlett-Packard Co.
- Hyundai Electronics America
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- NEC Technologies Inc.
- Northgate Computer Systems Inc.
- Packard Bell Electronics Inc.
- PC Brand Inc.
- Sharp Electronics Corp.
- Swan Technologies Inc.
- Tandon Corp.
- Tandy Corp./GRiD Systems Corp.
- Texas Instruments Inc.
- Toshiba America Information Systems Inc.
- Unisys Corp.
- Wang Laboratories Inc.
- Wyse Technology Inc.
- Zenith Data Systems
- Zeos International Ltd.

When you buy a new computer, you usually base your decision on the features you want and the performance you need. But when you start using that new machine, you are likely to become as concerned about the machine's reliability and how well it will be serviced if something goes wrong.

As the power of personal computers has increased, performance differences have narrowed between machines of the same class from major manufacturers. As a result, service and reliability issues have become more important to people who buy computers and to the companies that make them.

For our 1992 Service and Reliability Survey—the second such survey we have published—we spent several months gathering data on our readers' experiences with the desktop and laptop computers they have used over the past two years. Our results are based on 8,592 responses to a mail survey of randomly selected subscribers. We report details on 35 manufacturers, for which we received at least 50 responses each. This survey was mailed to 17,000 subscribers last fall, and we accepted results from November 1991 to January 1992. Excluding 125 surveys the U.S. Postal Service did not deliver,



that's a response rate of 51 percent. The survey was conducted in conjunction with Willard & Shullman, an independent research firm based in Greenwich, Connecticut.

We asked our readers to rate the reliability of their personal computers, along with the reliability of specific components in these machines. We asked them about their satisfaction with repair service or technical support they received. And we asked them what may have been the most important question in the survey: whether they were likely to buy another system from the same manufacturer.

In general, the results were surprisingly positive. On a scale of 1 to 10 (the maximum), the average reliability rating for our readers' desktop machines was 8.51. Not only did we see very positive overall results, reliability seems to be increasing. Each new generation of microprocessor scored slightly higher than its predecessor.

DESKTOP RESULTS

In terms of the overall reliability of desktop machines, nearly all the vendors did well. The average score of 8.51 was quite high. The range between the manufacturer with the highest score (Gateway 2000, at 9.13) and the one with the lowest score (Tandon Corp., at 7.58) was relatively small. This suggests that most name-brand PCs are highly reliable. Such consistency is not surprising, since most manufacturers base their machines on similar components.

Other manufacturers whose PCs scored well in terms of reliability were AST, Compaq, CompuAdd, Dell, Hewlett-Packard, IBM, Northgate, Swan, Toshiba, and Zeos. The results indicate a good showing by both the old-line computer manufacturers (such as HP and IBM, who have been known for high-quality but relatively expensive equipment) and by several of the newer mail-order companies (such as Dell, Swan, and Zeos, who make less expensive machines from standard components).

The high ratings for companies such as Gateway, Zeos, CompuAdd, Dell, Northgate, and Swan indicate that companies that sell direct (by mail) have delivered machines that our readers consider to be extremely reliable. While price competition has obviously played a key role in the explosive growth in the direct channel in recent years, our study shows that direct buyers have generally found

they have not been sacrificing reliability when they turn to lower-cost PC manufacturers.

You should keep in mind that the tremendous growth Gateway and Zeos have experienced in the past several years means that their customers tend to have newer machines; such machines are mostly based on more recent microprocessor, video, and hard disk subsystems, which you would expect to have better reliability.

In general, machines based on the newer CPUs did better than machines based on older technologies. Thus, 486-based PCs scored an average of 8.89, 386SXs scored 8.80, and 386s scored 8.77; all three are significantly better than the averages for machines based on the 286 (8.52) or 8086/8088 (8.48). Even older machines generally did fairly well on reliability. The 486SX chip was too new at the time of the survey for us to extract reliable data.

The differences among microprocessors become more apparent when you look at respondents' satisfaction with their repair experiences. Respondents were generally happier about the repair of 486 machines (with an average of 8.67) than with older processor types. Personal computers based on the 386SX came in second (8.34), followed by those based on the 386 (8.28), the 286 (7.89), and the 8086/8088 (7.72). The trend in scores probably reflects fewer breakdowns on newer machines and the largely successful efforts of system vendors to make their machines easier to repair.

In the category of satisfaction with repair, AST, CompuAdd, Dell, DTK, Gateway, HP, IBM, Northgate, and Zeos received marks that were significantly better than average. But while many vendors did not fare quite as well, the average score was still a respectable 7.93.

There was even more variation in the rating of technical support. Top scores went to Dell, Northgate, Swan, and Zeos. The average rating for tech support was 7.48, and scores went all the way down to 5.88. AST, CompuAdd, Digital, Everex, Gateway, and HP also had results in this category that were significantly higher than average.

In the repair experience and technical support categories, the top spots went to companies that primarily sell their computers through the direct-mail channel. This is significant; these companies have

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often emphasized technical support with features such as toll-free support lines and on-site service contracts, perhaps reflecting a need to create a closer relationship with their customers and to overcome customer reluctance to buy via mail. Indeed, several market leaders who have been known for their reliance on the dealer channel, including Compaq and IBM, scored average or below average on these measures.

The key question to ask after a buyer has had some experience with a product is: "How likely would you be to buy a new machine from the same manufacturer?" As in the other categories, the direct-mail companies received high ratings when we posed this question: Gateway scored 9.02, significantly better than any other manufacturer. Austin, CompuAdd, Dell, Northgate, Swan, and Zeos—all direct sellers—also got high marks, however. This category also had the widest range of scores in the survey, a signal of widely different opinions. Scores ranged from Gateway's 9.02 down to Wang's 4.39, with an overall average of 6.42.

Of the four numbers for each company, you may want to look most closely at the rating representing the likelihood of purchase. It factors in tangibles such as reliability and intangibles such as the perceived system value. Wang, for instance, finished last on these ratings; given the rocky road Wang traveled in the past few years, buyers may want to see reliability both from their machines and their companies. Buyers also want to see a fair balance between reliability, performance, and price. Note that two of the best-known vendors—Compaq and IBM—were in the top ten on reliability and scored far lower

than many mail-order companies on future likelihood of buying.

LAPTOP RESULTS

In this category, 386SX-based laptops did better than machines based on other chips.

Though the 386SX was not the newest CPU available at the time of this survey, we did not get enough responses from participants with 386SL- or 486-based laptops to analyze the user experience in those categories validly.

AST and Zeos topped the poll in terms of overall reliability with laptops, followed closely by Compaq, Dell, and Toshiba. In the areas of repair experience and satisfaction with technical support, Dell and Zeos had scores that were significantly higher than average. Both companies also ranked high on the list of laptop makers from which users would be likely to buy laptops in the future. AST, Compaq, and Toshiba also scored well in this category.

MAIL-ORDER WINNERS

The biggest winners in our survey are the direct-mail desktop PC vendors, which collected consistently high scores. Six of these firms—CompuAdd, Dell, Gateway, Northgate, Swan, and Zeos—received significantly higher-than-average marks on all of our four measures: reliability, satisfaction with PC repair experience, satisfaction with PC technical support experience, and the future likelihood of buying from the same manufacturer.

Of course, more factors than service, support, and reliability go into a possible plan to buy in an undetermined future. Price and performance, availability, compatibility, and a manufacturer's reputation are large components in making the buying decision.

Traditional sales leaders such as Compaq and IBM scored near the top on reliability, but they did not fare as well for the other measures, and they received average or below-average ratings on the "likelihood of buying" question. In recent months, both firms have announced or introduced new programs in an effort to be more responsive to the market and

more price-competitive with the mail-order firms that are eating their lunch. IBM, for example, has been developing a toll-free telephone program that will help

consumers arrange for technical support or repair service. Compaq introduced an on-site service option several months ago and has been promising a host of new options that will be available to its customers.

Reputation and past history can also influence a vendor's rating. For instance, Digital re-

ceived average and above-average scores on reliability, satisfaction with repair, and satisfaction with technical support—but scored significantly below the average in terms of the future likelihood of buying. At the time the question was asked, Digital was nearly invisible in the PC arena and was plagued by a history of fairly expensive machines that were not really PC-compatible. Since then, Digital has introduced a completely new line of PCs and revamped its support policies. It is too early to judge how these changes will impact sales for Compaq, Digital, and IBM PCs.

A BETTER SAMPLE

The quantitative results of this year's survey cannot be compared against the one we did two years ago because the methodologies are so different. In 1990, we bound a questionnaire into copies of the magazine and got back 20,000 responses. We believe this survey's randomly selected sample is far more scientific. But with that caveat, we will make some broad observations about differences between 1990 and today.

In 1990, readers complained about PC breakdowns (still mostly concerning 8088s and 286s), but they paradoxically declared they were highly satisfied with the reliability of their machines. Their big complaint at the time: service. Then, as now, the mail-order houses cleaned up: Dell, Northgate, and Swan topped the list in technical support and repair service. This year, the mail-order folks also domi-

nate the reliability category; in 1990, HP and NEC took that honor.

Some names have dropped off this year's list: Kaypro Corp., which is struggling in bankruptcy, and Commodore, which reached its high point in the U.S. market with its Commodore 64 but never matched that success with its other computers.

The 1992 rankings of service and reliability are only a guide to help you assess a systems manufacturer. You should also look at the specific performance, features, and price of the personal computers you may want to purchase. On the next few pages, you will find a compilation of our readers' opinions about the manufacturers whose systems they have used over the past two years, along with a summary of the firms' service and support policies. We believe these results will be helpful to you when you choose your next PC.

ACER AMERICA CORP.

by Bruce Brown

Average performance can seem uninspired, but consumers interested in a product's reliability may find it reassuring to know that users' experiences have been right down the middle in all categories for all companies. Acer America Corp.'s desktop PCs scored average for reliability (8.49 versus the 8.51 average), satisfaction with repair experience (8.09 versus the 7.93 average), and satisfaction with technical support (7.43 versus the 7.48 average). The likelihood that current owners would buy from Acer again came out to 6.72, also not far from the 6.42 average.

Our survey covered Acer desktop systems with 286 and 386 processors. In no case did any rating significantly exceed or fall below the norm for the group. All the ratings of individual components for both 286 and 386 systems—motherboards, hard disks, floppy disk drives, monitors, video graphics boards, keyboards, internal modems, and power supplies—came close to the average for their respective categories, indicating that users were generally satisfied with both the components and the full systems.

Acer sells computers to distributors that then resell them to dealers and value-added resellers (VARs). The company will extend the standard one-year parts-and-labor warranty at a cost that depends

on the particular system's configuration. Acer provides standard warranty service at its own facility in California or at authorized resellers and service centers. The company pays for return shipping on warranty repairs only and sends the unit back to the customer.

On-site service is optional. Acer offers it through two service vendors: ISC-Bunker Ramo, located in Tacoma, Washington; and Intellogic Trace of San Antonio, Texas. As is the case with extended service contracts, the price for on-site service depends on the particular system configuration.

Although users can access an on-line bulletin board to get information about products, Acer does not offer telephone technical support to end users of its desktop systems. Instead, callers to Acer's technical support number get a return call referring them to a local dealer. Despite the lack of telephone support, current users indicated an average level of satisfaction with Acer's established support and repair service. On March 1, Acer launched a forum on CompuServe to provide additional customer support.

FACT FILE

Acer America Corp., 2641 Orchard Pkwy., San Jose, CA 95134; technical support, 800-637-7000; sales, 800-733-2237; fax, 408-432-6221.

CIRCLE 487 ON READER SERVICE CARD

ADVANCED LOGIC RESEARCH INC.

by Bruce Brown

Advanced Logic Research stood out in one important measure of quality: the reliability of its monitors. Monitors rated a 9.02—significantly higher than the 8.78 average on the scale of 10 used to measure user satisfaction with the quality of individual components. For all other ratings, ALR's standing with our respondents fell comfortably within the average range for these categories.

ALR sells a wide variety of systems, including several 486 configurations, but we only received enough responses in the 386SX and 386 categories to evaluate these individual components by processor type. Every score for 386SX systems, including those for individual compo-

nents as well as those for overall reliability, future likelihood of buying from the same manufacturer, satisfaction with repair experience, and satisfaction with technical support had ratings in the middle range.

ALR's 386 desktop systems' ratings dropped in two important categories: satisfaction with repair experience (7.47 versus the 8.20 average for 386 desktop systems) and technical support (7.05 versus the 7.72 average). In terms of reliability, the likelihood users would buy again from ALR, and component ratings, ALR's 386 desktop systems rated close to average in satisfaction.

ALR systems are sold through VARs, value-added dealers (VADs), and major dealers and chains throughout the country. Recently, the company announced a renewed commitment to dealers with improved inventory stocking, co-op advertising, and sales-support materials. ALR is resisting the trend toward direct sales and intends to continue selling through and supporting its current dealer channels.

In a move that makes the company more accessible to customers, ALR has recently upgraded its end-user service-and-support policies. System owners, who were once referred to dealers and resellers for help, can now receive toll-free technical support directly from ALR Monday through Friday between 6:00 and 5:00 P.S.T. and Saturdays from 7:00 to 1:00. Other ALR support enhancements include a fax request line for product literature.

ALR's standard one-year warranty includes depot service from the factory, from dealers, or from Intel Service Centers. On-site service contracts, extended warranties, and a premium VIPCare Maintenance program that includes a 24-hour repair turnaround are all available at an extra cost. In each case, upgraded service arrangements are sold through resellers and the cost is determined by the system configuration.

While the support you get for computers sold and supported through resellers is always subject to the quality of the individual reseller, ALR's recent end-user and dealer-support policy upgrades bode well for buyers in the future. ALR users already appear to be a satisfied group; the new policies should improve the areas where there has been some dissatisfaction.

FACT FILE

Advanced Logic Research Inc., 9401 Jeronimo Dr., Irvine, CA 92718; technical support, 714-458-0863; sales, 800-444-4257; fax, 714-581-9240.

CIRCLE 488 ON READER SERVICE CARD

AST RESEARCH INC.

by Bruce Brown

Users of AST Research's desktop and portable computers are a satisfied lot. Our survey found that their likelihood of buying from AST again was significantly higher than average for both desktop PCs (7.33 versus the average 6.42) and notebook PCs (8.33 versus the 6.87 average). The ratings of desktops were significantly higher than average for reliability (8.77 versus the 8.51 average), satisfaction with repairs (8.21 versus the 7.93 average), and satisfaction with technical support (7.78 versus the 7.48 average). In the same three categories, notebooks brought in average ratings.

When it came to the reliability of individual components, AST's desktop units retained their above-average standing, scoring significantly higher for hard disks, floppy disk drives, monitors, keyboards, and power supplies; motherboards, video graphics boards, and internal modems garnered average ratings. Notebooks scored significantly higher than average for their hard disks, floppy disk drives, and power supplies but registered average scores for the motherboards, screens, keyboards, internal modems, and battery packs.

We received enough responses to be able to evaluate both the 386SX-based notebooks and the 286-, 386-, and 386SX-based desktops by CPU class. In all these categories, the likelihood that respondents would buy AST desktops and notebooks in the future was above average. In each microprocessor category, ratings for the reliability of individual components were average for both notebooks and desktops.

AST sells solely through dealers but backs the dealers with a variety of service-and-support programs. The standard one-year warranty does not include on-site service, an option often available from dealers. AST does sell extended warranties; costs depend on the system configuration.

AST offers toll-free technical support six days a week. Although both AST's 24-hour on-line BBS and its Info-FAX line require a toll call, the fax line is automatic: Customers can use Touch-tone menus to have technical documents sent to their fax machines.

AST notebook customers have the same service-and-support opportunities as desktop owners, with one notable addition. For \$45 per year, any AST notebook owner can purchase an ExecCare service upgrade program that offers 24-hour replacement or repair and the use of a loaner while the notebook is being repaired.

Corporate customers who manage many AST systems may be interested in AST's high-end support programs, including a technical-publication subscription service for \$195 a year and two premium programs. These programs, which have annual fees of \$1,800 and \$2,500, offer such benefits as discounts on spare parts and expedited service and shipment. Premium support customers must agree to AST standards for in-house support and training and with the more expensive program must meet an annual minimum level of system and spare-parts purchases.

AST periodically upgrades its service-and-support policies. The end-user technical support line is a recent addition. Based on our results, it appears that AST's mixture of manufacturer and dealer support and service works well for both desktop and portable computer users.

FACT FILE

AST Research Inc., 16215 Alton Pkwy., P.O. Box 19658, Irvine, CA 92713-9658; technical support, 800-727-1278; sales, 800-876-4278; fax, 714-727-9355.

CIRCLE 489 ON READER SERVICE CARD

AT&T COMPUTER SYSTEMS

by Bruce Brown

AT&T Computer Systems no longer sells personal computers directly; it has turned its computer business over to NCR Corp., which AT&T acquired after a protracted struggle. If NCR is to succeed in selling AT&T's desktop units, it will have to overcome a great deal of dissatisfaction among present AT&T customers. Our survey shows that AT&T's

product line scored well below average in all four categories: reliability (8.21 versus the 8.51 average), satisfaction with repair experience (7.38 versus the 7.93 average), satisfaction with technical support (6.45 versus the 7.48 average), and future likelihood of buying from the same manufacturer (4.61 versus the 6.42 average).

Though the company also markets a line of notebook computers, including the aesthetically pleasing Safari line, we did not receive enough responses to evaluate products in this category.

AT&T was an early rival of IBM, producing PCs at a time when few other companies had risen to the desktop challenge. Our survey, which covers systems based on 8086/8088, 286, 386SX, and 386 CPUs, included some of AT&T's earliest models. AT&T's 8086/8088s and 286s bore the brunt of user dissatisfaction, but they were also among the systems users had owned the longest.

AT&T systems ratings fell significantly below average in all microprocessor classes when respondents were asked if they were likely to buy AT&T machines again. The company's 8086/8088 and 286 computers rated lowest in reliability, but its 386SX and 386 systems climbed into the average range. The company garnered similar ratings for technical support: below average in the 8086/8088, 286, and 386 categories, within average for 386SXs. AT&T did manage to eke out average ratings for user experience with repair services in the 286 and 386SX categories, but below average for the 386s.

NCR sells AT&T desktop PCs through dealers and via a direct-sales force to large-volume customers. The standard warranty covers one year of depot service. NCR also supplies on-site service for \$40 more during the first year.

Technical support via an 800 number and an on-line BBS is available only to customers who purchase a maintenance contract, the cost of which depends on the computer model and configuration. A one-year maintenance contract for a 386 desktop system with a 200MB hard disk, for example, costs \$529. Buying the maintenance contract for successive years keeps the system under warranty and maintains user access to technical support.

With fairly bleak ratings and high maintenance costs, NCR faces an uphill task in building user confidence for its AT&T desktop PCs.

FACT FILE

AT&T Computer Systems., 1700 S. Patterson Blvd., Dayton, OH 45479; sales, 800-225-5627; fax, 513-252-9541.

CIRCLE 527 ON READER SERVICE CARD

AUSTIN COMPUTER SYSTEMS INC.

by Joseph Desposito

Austin Computer Systems, the recipient of several Editors' Choice awards for its desktop PCs, seems to be doing a creditable job of satisfying the service-and-support needs of its mail-order customers. Austin customers were more likely than average to buy another Austin system in the future (7.91 versus the 6.42 average). The company earned solid but not significantly higher-than-average scores for overall reliability (8.65 versus the 8.51 average), satisfaction with repair experience (8.44 versus 7.93), and satisfaction with technical support (7.93 versus the 7.48 average).

Austin's product warranty is for one year. At the end of the 12-month period, you may extend the warranty for an additional year. The cost of this extension is priced at 10 percent of system cost minus software and shipping costs. Like many manufacturers who sell direct, Austin offers a 30-day money-back guarantee.

The prices for Austin systems include one year of on-site service, handled by GE Computer Service of Norcross, Georgia, but you can send equipment back to Austin for repairs. Austin pays for return shipping by the same mode of transportation you used. The company will send parts by overnight express mail.

Austin offers unlimited toll-free technical support 24 hours a day, 365 days a year. It does not exclude any support calls: Even if you bought the software or hardware on your own, support personnel will help you out as long as you are using it on an Austin system. Austin also maintains a bulletin board service.

We received too few responses to generate ratings by processor class for Austin systems. This is also the reason why Austin's notebooks were not included in this study.

The results, however, show that Austin gets solid scores from satisfied customers. With generous around-the-clock technical support and troubleshooting assis-

tance for third-party products, it is easy to see why Austin did so well.

FACT FILE

Austin Computer Systems Inc., 10300 Metric Blvd., Austin, TX 78758; technical support, 800-752-4171; sales, 800-752-1577; fax, 512-454-1357.

CIRCLE 490 ON READER SERVICE CARD

BONDWELL INDUSTRIAL CO. INC.

by Michael Cohn

Bondwell Industrial Co.'s track record in the personal computer business goes back to the hoary days of CP/M. The company must have learned something along the way. Readers who use Bondwell laptops showed an average level of satisfaction with their systems. Satisfaction with Bondwell's repairs and technical support came out to 7.43 and 7.41, respectively, roughly the same as the respective average scores of 7.59 and 7.52 in these categories. Overall reliability was put at 8.51, compared with the average rating of 8.59. When asked if they were likely to buy another Bondwell laptop, users said yes at about the standard rate for all survey participants: 6.60 versus the 6.87 average.

Most components in Bondwell's 286-based notebooks earned reliability ratings that are significantly higher than average. The motherboard scored 9.36 versus the 8.92 average for all 286 notebook motherboards. The hard disk earned a 9.11, which is also high when compared with the 8.65 average for 286 notebook hard disks.

The one setback for Bondwell was the overall reliability rating for the battery pack its systems use. At 7.18, the company rated significantly below the 8.00 average. This score reflects the below-average rating for the battery pack in Bondwell's 286 laptops, which also came in significantly below average. We did not receive enough responses to evaluate Bondwell's more powerful notebooks by processor class.

Bondwell could not explain the low rating of its battery packs, claiming it uses the same kind of nickel cadmium battery packs found in many comparable machines. Its hard disks, which also rated well, are made by Conner Peripherals.

COVER STORY SERVICE AND RELIABILITY

Bondwell provides free technical support via an 800 number from 8:00 to 6:00 P.S.T. It offers a one-year parts-and-labor warranty on all its machines, including its desktop PCs. The machines come with a 30-day no-question money-back guarantee.

Bondwell sells a one-year extended service plan beyond its warranty period, at costs ranging from \$120 to \$220, depending on the machine and whether you want to cover the hard disk. The program does not cover batteries or adapters.

Bondwell has discontinued third-party and on-site servicing but is considering establishing dealer-authorized service. In the meantime, it prefers to make repairs at its factory in Fremont, California, to control quality. The company projects a turnaround of five to seven days for repairs and will pay for return shipping by UPS Blue second-day service. It will send the machine back by overnight mail if you ask, but you must pay extra.

FACT FILE

Bondwell Industrial Co. Inc., 47485 Seabridge Dr., Fremont, CA 94538; technical support, 800-288-4388; sales, 510-490-4300; fax, 510-490-5897.

CIRCLE 491 ON READER SERVICE CARD

COMPAQ COMPUTER CORP.

by Patrick Honan

Compaq Computer Corp. raced to prominence during the 1980s largely because corporate PC buyers saw this company as a quality alternative to IBM. Responses to our survey show that Compaq's customers still rated it high for reliability and quality, but the company no longer stands out from the rest of the pack. In fact, Compaq's chief competition in several key survey categories came from mail-order companies.

On our survey, the company earned better reliability scores for its desktop

PCs than it did for its laptop PCs. Users gave Compaq a score of 8.75, significantly higher than the 8.51 average, but the 8.74 reliability rating for laptops was too close to the 8.59 average to be statistically meaningful. In the same category,

mail-order vendor Dell Computer Corp. scored 8.80 for its laptops, while Zeos International gained a significantly higher score of 9.18.

Laptop users gave Compaq high scores in other categories. Satisfaction with repairs rated

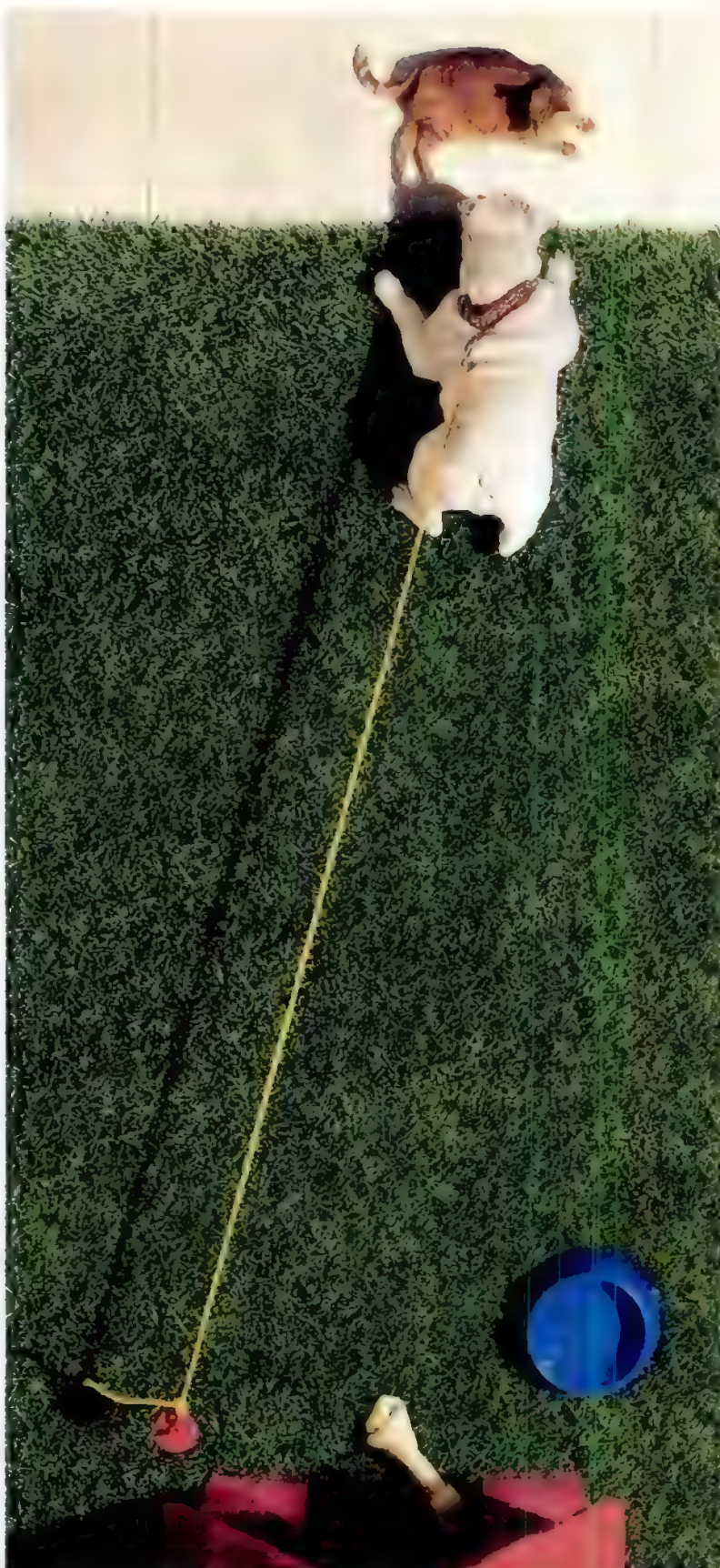
7.94, significantly higher than the 7.59 average. (Its 7.79 rating for satisfaction with technical support was not significantly higher than the 7.52 average.) Among desktop users, Compaq slipped in both these categories: While its 7.93 score matched the average for repair satisfaction, Compaq came in at 7.22 on technical support, well below the 7.48 average.

Our respondents indicated mixed feelings when we asked if they were likely to buy another Compaq computer. The 6.43 score among desktop users was about average for all brands. But ratings from Compaq laptop users exceeded the average level of enthusiasm (6.87) among our survey participants with a 7.18 score. Nevertheless, the mail-order vendors—Compaq's most significant competitors—seemed to be doing a better job of enticing customers to buy both desktops and laptops direct in the future.

Buyers of Compaq's most powerful 486 systems seemed reasonably satisfied with their machines. Compaq's 8.63 score on reliability was about average while noticeably below the scores for Gateway (9.09) and Zeos (8.91). Users gave average scores for repair services (8.30 versus 8.73) and technical support (8.49 versus 8.43). But they were somewhat less likely than the average buyer to consider purchasing another Compaq system in the future (7.35 versus 8.30)—possibly because of the price premium at the time of our survey.

Compaq backs all its systems with a one-year parts-and-labor warranty and toll-free technical support, and the company has promised some additional changes from its former "go to your dealer" policy. Already, users can re-

*Buyers of Compaq's
powerful 486 systems
seemed satisfied
with their machines.*



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ceive technical specifications and product information via a toll-free fax line. TRW, GE Computer Service, and Intellogic Trace provide on-site service as an option. Notebook users under warranty get a card that entitles them to free repairs at any authorized Compaq repair location in the world.

Compaq says its goal is to offer the best service and support in the computer industry. Based on our survey, Compaq is not there yet but may be getting closer, especially with the new support policies it is planning to offer—but has not announced—later this year.

FACT FILE

Compaq Computer Corp., P.O. Box 692000, Houston, TX 77269-2000; technical support, 800-345-1518; sales, 800-231-0900; fax, 800-345-1518.

CIRCLE 492 ON READER SERVICE CARD

COMPUADD COMPUTER CORP.

by Patrick Honan

One important measure of satisfaction is whether the customer is willing to come back for more. Our survey indicates that CompuAdd Computer Corp.'s mostly mail-order customers are quite willing to spend money in the future on the company's products. This rating reflects their happiness with the reliability, service, and support provided by the company.

CompuAdd makes both desktop and laptop systems. Ratings for both were good, but CompuAdd's desktop computers tended to score higher against the field than its laptops. For example, ratings for desktop PCs were all significantly higher than average on overall reliability (8.74 versus the 8.51 average), satisfaction with repairs (8.42 versus the 7.93 average), and satisfaction with technical support (8.25 versus the 7.48 average). Scores for the company's laptops fell within the average range for each of these categories.

Among individual processor types for desktop PCs, several scores stood out as significantly higher than average: CompuAdd's 386DX computers scored 8.91 for overall reliability against an average 8.68, and its 286s scored 8.23 for satisfaction with technical support (versus the 7.28 average).

While both laptop and desktop cus-

tomers were bullish about the likelihood of buying CompuAdd systems in the future, they showed more enthusiasm here too for desktop systems over laptops.

CompuAdd's warranty coverage and support policies are about average for manufacturers who sell direct. All products are covered by a one-year warranty and a 30-day money-back guarantee. Desktop 386 and 486 full-profile and tower systems come with one year of free on-site service; for other desktops and all laptops, on-site service is a \$90 option. Memorex Telex, headquartered in Dallas, Texas, provides CompuAdd's on-site service. CompuAdd maintains a 24-hour BBS, a fax line, and toll-free telephone support weekdays from 8:00 to 7:00 C.S.T.

CompuAdd has no specific plans to expand its support services, but the company says it will negotiate with customers to fulfill any special needs. For example, if a company bought a server and networking software from CompuAdd and wants it installed, CompuAdd would perform the installation and negotiate the fee as part of the purchase price.

FACT FILE

CompuAdd Computer Corp., 12303 Technology Blvd., Austin, TX 78727; technical support, 800-999-9901; sales, 800-627-1967; fax, 512-331-6236.

CIRCLE 493 ON READER SERVICE CARD

DELL COMPUTER CORP.

by Joseph Desposito

Dell Computer Corp. is one of the great success stories of the PC industry, and its products have earned a number of *PC Magazine* Editors' Choice awards. The company has also been a pacesetter in legitimizing the direct market through high-quality service and support. There is no sign that Dell is resting on its laurels. On our survey, Dell's desktop PCs ranked significantly higher than average in all four key areas. Its reliability score of 8.77 bests the average score of 8.51; customers' future likelihood of buying from Dell was rated at 7.77 versus the 6.42 average; satisfaction with repair experience came to 8.53 versus the 7.93 average; and satisfaction with

technical support was 8.67 versus the 7.48 average.

Dell also topped the list of laptop manufacturers that users said they would likely buy from again in the future (8.53 versus the 6.87 average); respondents also gave high scores when it came to satisfaction with repair experience (8.89 versus the 7.59 average) and satisfaction with technical support (9.12 versus the 7.52 average).

Dell customers reported on 286, 386SX, and 386 desktop PCs and 386SX laptops and notebooks. For desktop machines in each CPU category, almost all of Dell's ratings were significantly higher than average. But of the five vendors (AST, Compaq, Dell, Toshiba, and Zeos) that received enough responses about customer satisfaction with 386SX notebooks, Dell received the best rating for respondents' satisfaction with technical support (9.09 versus the 8.44 average).

Dell's warranty on products is for one year, but you can extend it for four years more. The cost depends on the system you purchase and your geographic location. Dell has a 30-day return policy, no questions asked. The company accepts equipment for repairs and ships it back the same way you sent it. Dell has an unusual policy on notebooks, however: It transfers all the data from the unit's hard disk to a replacement unit, which the company supplies the next business day.

The system price includes one year of on-site service now supplied by BancTec Service Corp. (BSC). Through its CriticalCare policy, available in 17 major cities, BSC responds to requests for on-site service within 4 hours. BSC was once Novell's original on-site service partner; in 1989, it took over almost all of Novell's direct end-user service contracts. Dell systems originally serviced by Xerox Corp. will continue to be serviced by Xerox unless the customer opts to pay for a change to BSC.

Dell sells both direct and through dealers, such as Dallas-based CompUSA, a computer superstore; and Staples, an office supplies superstore. The company offers unlimited toll-free technical support 15 hours a day weekdays and 8 hours on Saturdays. In addition to a 24-hour bulletin board, customers can call a 24-hour automated fax service called TechFax, at 800-950-1329, for detailed technical specifications of Dell systems.

Our survey shows that Dell has done an admirable job in the past. The company



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seems to be working hard to maintain its sparkling reputation.

FACT FILE

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; technical support, 800-624-9896; sales, 800-289-3355; fax, 512-338-8700.

CIRCLE 494 ON READER SERVICE CARD

DIGITAL EQUIPMENT CORP.

by Tom Unger

Digital Equipment Corp. has long been associated with minicomputers and networked workstations. In fact, Digital was one of the earliest companies to introduce a personal computer: the CP/M-based DEC Rainbow. Since then, Digital has added a mainframe and a full line of DOS computers to back up its sales pitch for total networked office systems. The largest portion of DEC's PC sales comes from the direct-to-consumer channel, but the company also sells some of its desktop PCs through resellers.

Our survey indicates that users of Digital's systems have found them about as reliable as its market competitors, Wang Laboratories and Unisys Corp. The company's 8.17 score for reliability did not differ significantly from the 8.51 average for desktop PC users who responded to this survey. Users indicated a strong reluctance, however, to buy Digital PCs in the future (4.99 versus the 6.42 average). This negative rating may reflect the user awareness of direct-market companies offering networked systems and on-site service at significantly lower prices than the premium rates Digital has been known to charge.

Nevertheless, the user response for satisfaction with repair experiences, at 7.91, was average, suggesting that Digital customers were generally pleased with the quality of service they get. In keeping with the emerging PC industry standard—and the hand-holding traditions of the minicomputer market—Digital offers next-day on-site service from the manufacturer.

Digital includes on-site service free with its one-year parts-and-labor warranty. Customers whose businesses rely heavily on computers can purchase same-day coverage at a price that depends on the

COVER STORY SERVICE AND RELIABILITY

system and its configuration. A company representative noted that Digital's technicians will work for no extra cost on any PC in a network—not just those manufactured by Digital.

Digital had an above-average satisfaction rating for the company's technical support. The company's score of 8.00 tied that of Everex Systems and compared favorably with that of Northgate Computer Systems (8.82), though the score was still significantly lower than Dell Computer Corp.'s rating of 8.67 and Zeos International's 8.50 rating. Digital offers a 30-day money-back guarantee on all its desktop PC systems. Free technical support is available via a toll-free number weekdays from 8:30 to 8:00 E.S.T. and through CompuServe.

FACT FILE

Digital Equipment Corp., 305 Foster St., Littleton, MA 01460-1450; technical support, 800-722-9332; sales, 800-722-9332; fax, 800-524-5694.

CIRCLE 495 ON READER SERVICE CARD

DTK COMPUTER INC.

by John R. Quain

Eleven-year-old DTK Computer has traditionally avoided brand-name skirmishes in the PC marketplace and has concentrated on supplying motherboards, add-in cards, and bare-bones systems to distributors. Customers relied on independent dealers for support. Yet our survey shows that most users have found this low-key arrangement more than adequate. DTK managed to push its way into the top ten in customer satisfaction with repair service (8.20 versus the 7.93 average) and the likelihood that users would buy from DTK again (7.28 versus the 6.42 average). The company earned average grades for technical support (7.58 versus the 7.48 average) and reliability (8.55 versus the 8.51 average). But when the company finally plunged into the crowded market for fully equipped PCs late last year, it decided to beef up customer relations with a full service-and-support program.

Until then, DTK offered a vanilla one-year parts-and-labor warranty. Regional

offices and independent dealers performed most of the service and support, although DTK handled repairs and technical assistance if your dealer went out of business. The survey results indicate this approach worked quite well—likely a testament to DTK's choice of dealers.

DTK started upgrading its service and support last November. The company now offers toll-free technical support weekdays from 7:00 to 5:00 P.S.T. One year of free on-site service from GE Computer Service has been added for 386DX units (except the 25-MHz model) and 486 systems. Dealers can extend the same terms to purchasers of more modest systems for \$49. There is no extended on-site service option beyond the first year, however, and a second year of warranty coverage is expensive: \$249 for a 286, 386/25, or 386SX system; and \$349 for a 386DX or 486 system.

To strengthen the new program, DTK introduced a user BBS and fax service for technical assistance. More serious problems are handled by authorized DTK dealers; the company is finalizing plans for a dealer training program. Service is also available at authorized service centers and at five DTK regional offices in the U.S. The company will pay for the same kind of shipping you use to send in the computer.

DTK's revamped service and support program coincided with the introduction of its completely configured Gräfika line of PCs. Previously, distributors had customized the bare-bones DTK systems by adding their own choice of components, which made it difficult for DTK to provide technical assistance. The stripped-down systems are still available, but DTK's new support program is designed to spearhead the new line. To push the program along, the company even has a monthly newsletter and offers its own line of SPARCstations. These are ambitious moves by a manufacturer that managed to do well on *PC Magazine's* survey with just standard service and support.

FACT FILE

DTK Computer Inc., 17700 Castleton St., #300, City of Industry, CA 91748; technical support, 800-925-7318; sales, 800-472-3452 (Gräfika), 800-824-9385 (components); fax, 818-810-3722.

CIRCLE 496 ON READER SERVICE CARD



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HP network-ready LaserJets are actually seen as additional nodes on your network. Which allow you to manage from one location and take full advantage of the features in your network management software. There's even a new diagnostic feature which lets you track the success of data transfer between your server and a network-ready LaserJet.

Network-ready LaserJets were engineered in cooperation with NOS vendors. So they work seamlessly with your current network and operating system. Including Novell Netware (Novell-certified), 3COM 3+Open, Microsoft® LAN Manager, and IBM LAN Server. Or the HP-UX, SunOS, and SCO UNIX® operating systems. Even Macintosh environments.



HP LaserJet III HP LaserJet IIIi HP LaserJet IIId

LaserJets become network-ready with separately purchased HP JetDirect interface cards. And now these interface cards are available for only \$695-\$895.*

For a how-to source that provides information on hooking network-ready LaserJets into your system, call **1-800-752-0900, Ext. 3075** for the HP Connectivity Solutions Guide.



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*For operating HP-UX, SunOS and SCO UNIX, \$100 in additional software is required. All prices are suggested U.S. list prices. UNIX is a registered trademark of UNIX System Laboratories Inc. in the U.S.A. and other countries. Microsoft is a U.S. registered trademark of Microsoft Corp. ©1992 Hewlett-Packard Company PE12259

CIRCLE 116 ON READER SERVICE CARD

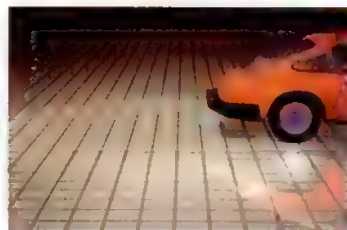
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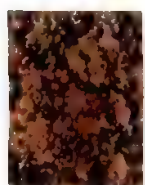
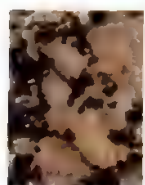
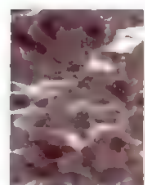
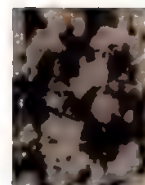
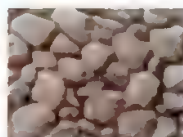
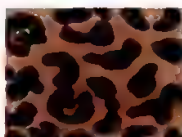
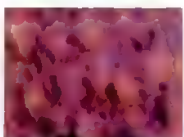
3D STUDIO RELEASE 2

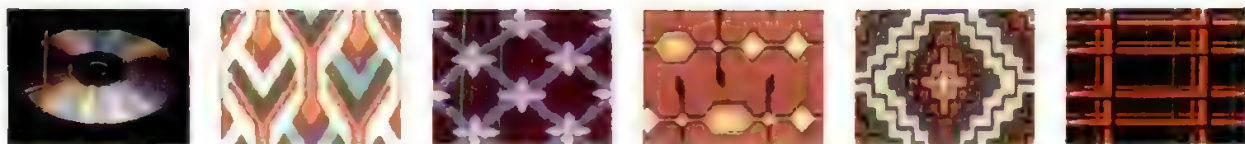
The new 3D Studio takes a quantum leap beyond version 1. The boost in rendering speed and 108 new features will ignite your imagination!

At the heart of 3D Studio™ Release 2 is an accurate, versatile 3D modeler that performs complex Boolean and spline-based operations. Its modeling flexibility makes the software easier to master than many 2D programs.



How fast is 3D Studio Release 2 software? The vase on the left was created from scratch in less than 30 minutes. And rendered in two minutes on a 486/33 PC!





This alone is worth a small fortune. A CD-ROM packed with more than 500 megabytes of prebuilt 3D objects and materials. Over 500 patterns and textures to work with, including 62 kinds of marble. Hundreds of meshes and animations that would take thousands of hours to create on your own.



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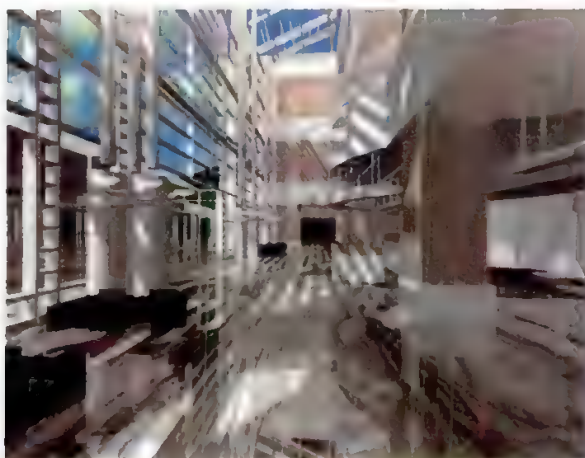


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AUTODESK

EPSON AMERICA INC.

by John R. Quain

Best known for its highly regarded dot matrix printers, Epson America has been in the computer business for nearly 16 years. Its early products included early CP/M laptops and a DOS PC that was not quite IBM-compatible. Our survey suggests, however, that Epson's computers don't live up to the enviable reputation of its printer market. Epson's desktop PCs earned ordinary scores, and our respondents perceived weaknesses in the company's laptops and notebooks.

Epson sells its systems through dealers and covers its equipment with a one-year parts-and-labor warranty. Second-year warranty extensions are available, ranging in price from \$138 for 386SX systems to \$270 for 486 PCs. The company does not include on-site service, though some dealers offer their own programs.

Our survey results showed that most respondents were reasonably satisfied with Epson's desktop systems. They gave average scores on reliability (8.52 versus the 8.51 average), the likelihood they would buy from Epson again (6.18 versus the 6.42 average), satisfaction with repair experience (7.75 versus the 7.93 average) and technical support (7.31 versus the 7.48 average). Epson's laptops and notebooks were also judged average in terms of reliability (8.46 versus the 8.59 average), technical support (7.06 versus the 7.52 average), and repair experience (6.69 versus the 7.59 average). But survey participants were less enthusiastic about buying another Epson laptop (5.48 versus the 6.87 average).

These results reflect Epson's policies before a recent decision to broaden service and customer support. For example, Epson now offers a unique on-the-road repair service for notebook owners. Purchasers of Epson notebooks will receive the standard one-year warranty as well as on-the-road coverage. If a replacement part is needed while you are away from home, Epson will ship a new part out overnight to any location in the U.S.—free. A prepaid airway bill is included with the package so that you can return the defective part.

Customers can get technical support via a toll-free number (weekdays from 9:00 to 8:00 E.S.T.), an automated toll-free fax service, and a BBS. Repairs are handled by 500 customer care centers and

about 1,700 authorized dealers across the U.S. Users can take their equipment into the nearest customer care center or return it to the dealer. To facilitate repairs under warranty, the company ships parts overnight to the dealer. Epson is clearly making an effort to keep customers happy. The company's latest efforts—particularly in regard to laptops—seem destined to make business users more confident about computing on the road.

FACT FILE

Epson America Inc., 20770 Madrona Ave., Torrance, CA 90503; technical support, 800-922-8911, 310-782-0770; sales, 800-922-8911; fax, 310-782-5220.

CIRCLE 497 ON READER SERVICE CARD

EVEREX SYSTEMS INC.

by John R. Quain

Sometimes the simplest plan is the best plan. On our survey, Everex Systems managed to achieve average or above-average ratings on reliability, technical support, and repair experience—without resorting to special programs or gimmicks.

Everex markets its systems primarily through independent dealers and offers a standard one-year parts-and-labor warranty on all its systems. The company relies on a combination of free on-site service, authorized service centers, and dealer support to maintain coverage. Telephone assistance is free for the life of the system but not toll-free.

Despite the lack of a toll-free line, our respondents gave Everex marks that were significantly above-average for technical support (8.00 versus the 7.48 average). Satisfaction with reliability and repair experiences was average, although respondents were particularly pleased with technical support for the company's 386 models (8.20 versus the 7.72 average for other vendors' 386 models). In general, participants were positive about the likelihood of buying another Everex system: The 7.17 rating was significantly better than the 6.42 average.

Although Everex expects most customers to turn to dealers for support, the

company does include on-site service. Everex's STEP systems receive free on-site coverage for the first year, while its Tempo systems are covered for the first three months. National Computer Service (NCS), which has 109 locations in the U.S., fulfills on-site obligations, but you must be within 100 miles of a service center to avoid additional charges.

You can extend the warranty and on-site coverage. Optional warranty coverage for the second year costs between \$90 and \$275, depending on the system configuration. Extending on-site coverage is more expensive: \$200 to \$500, depending on the system. For \$80, you can extend coverage for the Tempo from three months to one year.

In addition to NCS, Everex has about 125 authorized service providers around the country. To qualify as an authorized repair center, providers must attend a two-day training program, maintain two full-time technicians, and carry spare Everex parts. Hence, customers have the option of on-site repair; carry-in service; or mailing the system to Everex, for which the company will pay so-called one-way mirror shipping: It will send your system back via the same kind of carrier you used to send it the system. Everex estimates that its average response time for repairs is 48 to 72 hours.

Everex, already well known for its peripherals and OEM systems, provides a combination of service and support that earned it generally solid marks from survey participants. The question is how long the company can maintain that level of customer satisfaction without providing services—such as toll-free technical support—that are quickly becoming standard in the PC business.

FACT FILE

Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; technical support, 510-498-1115; sales, 800-821-0806, 510-498-1111; fax, 510-683-3398.

CIRCLE 498 ON READER SERVICE CARD

GATEWAY 2000

by Henry Fersko-Weiss

If the buying plans of satisfied customers could be taken to the bank, Gateway 2000 would have its future well in

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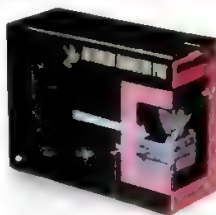


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 **AUTODESK**

1992 SERVICE AND RELIABILITY SURVEY

Scores for reliability were high across the board. Of the 35 manufacturers, AST, Compu-Add, Dell, Gateway, Hewlett-Packard, Northgate, and Zeos received higher-than-average marks in all four major categories.

Responses to four of the 1992 *PC Magazine* Service and Reliability Survey questions are shown here:

- overall PC reliability;
- future likelihood of buying from the vendor;
- satisfaction with repair service;
- satisfaction with technical support.

The survey also contained questions about the reliability of individual components. For desktop PCs, these included the motherboard, hard disk, floppy disk drives, video or graphics board, monitor, keyboard, internal modem, and power supply. For laptops, components included the motherboard, hard

disk, floppy disk drives, screen, keyboard, battery pack, internal modem, and power supply.

Respondents based their answers on any computers they had used during the two-year period prior to this survey. The responses were given on a scale of 1 to 10; a rating of 1 represented the least satisfaction, and a 10 represented the most satisfaction.

LAPTOP AND NOTEBOOK PCs

Only Zeos's portable PCs achieved significantly higher-than-average ratings in all four categories. Dell's scores were significantly higher than average in three of the four categories, but its overall PC reliability was average. Only ZDS's portables rated significantly lower than average in all four areas.

PC users gave AST, Compaq, Dell, Toshiba, and Zeos higher-than-average ratings when it came to the future likelihood of buying from the companies (the average score was 6.87). Epson, IBM, NEC, Tandy, and ZDS garnered ratings that were significantly below the average in this category.

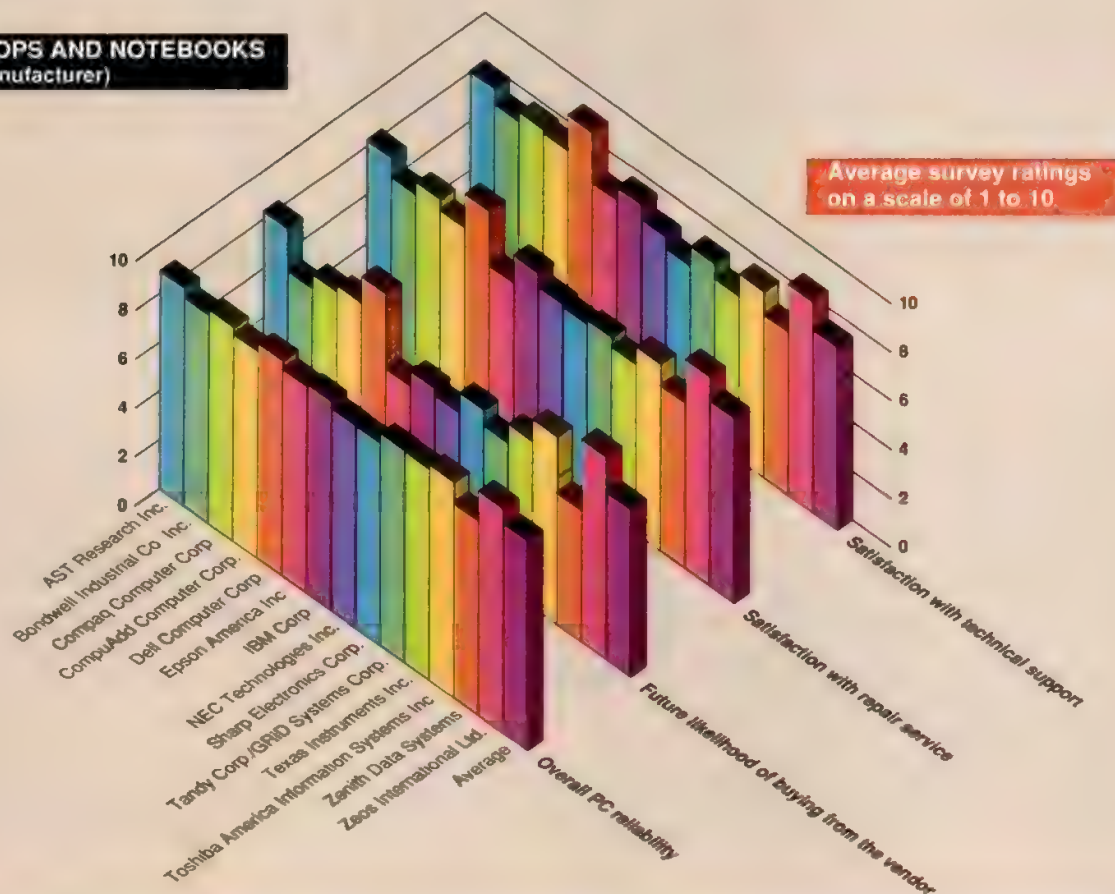
DESKTOP PCs

AST, CompuAdd, Dell, Gateway, Hewlett-Packard, Northgate, and Zeos received top honors. Each of these companies received scores that were significantly above the average in all four categories we deem most important: overall PC reliability (the average score was 8.51), future likelihood of buying from the vendor (6.42), satisfaction with repair service (7.93), and satisfaction with technical support (7.48).

For IBM, the message was mixed. Although the company received a high mark for the reliability of its computers, users gave it a lower-than-average rating for the future likelihood of buying from the company. IBM's ratings were above the average for satisfaction with repair service and average for technical support.

There were also three companies that trailed far behind the rest (though all scores were relatively high). AT&T, Wyse, and ZDS received marks that were significantly below the average in all four categories.

LAPTOPS AND NOTEBOOKS (by manufacturer)



CONTINUES

This "Ultimate-Power
Desktop PC" was chosen
Editors' Choice.

Here's why.

**MAGAZINE
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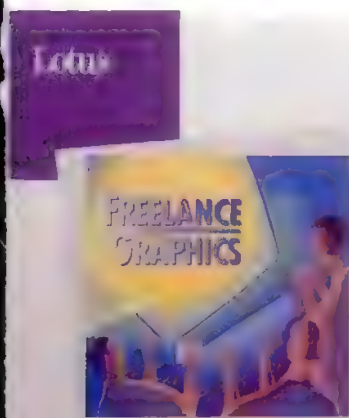
a couple hundred dollars more than the ZEOS 486-33. *Amazing.*

AND THAT'S JUST FOR STARTERS.

Because ZEOS combines the high speed upgradable processor of your choice with some of the fastest DRAM made. Both are mounted on your ZEOS system board, one of the most advanced in the industry. And that's where your new system really begins to shine.

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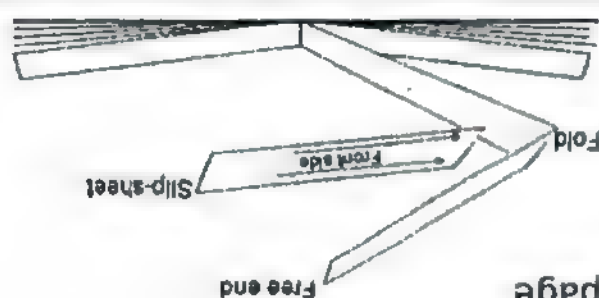


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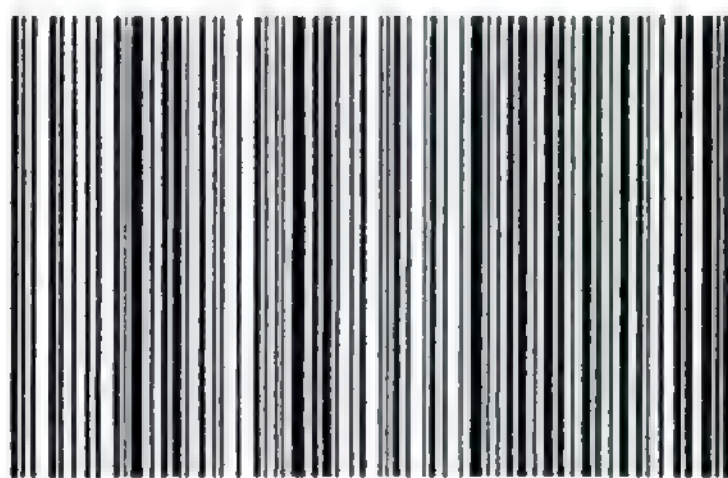
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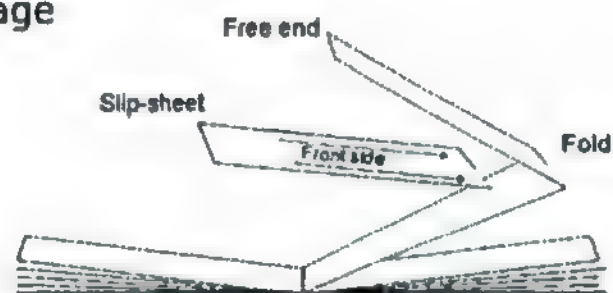
Inverted Foldout slip-sheet



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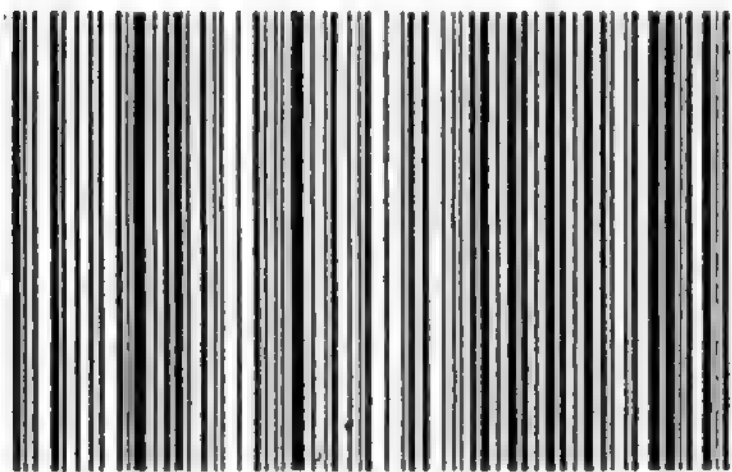
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Back

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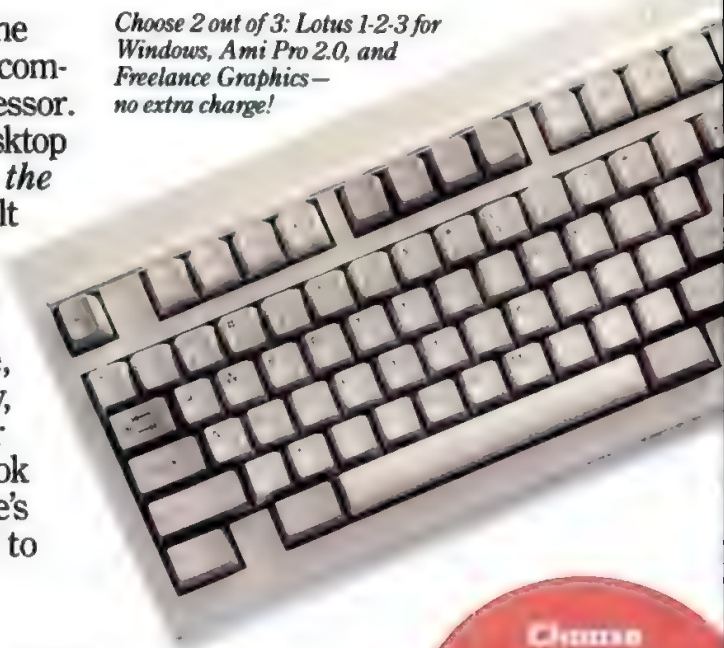
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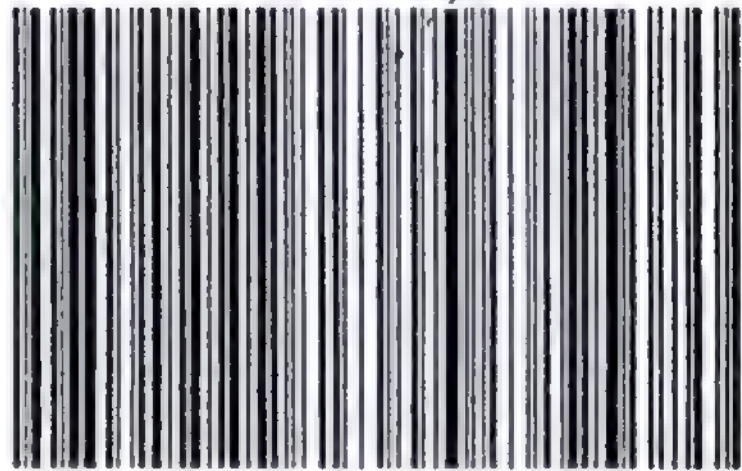
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Back

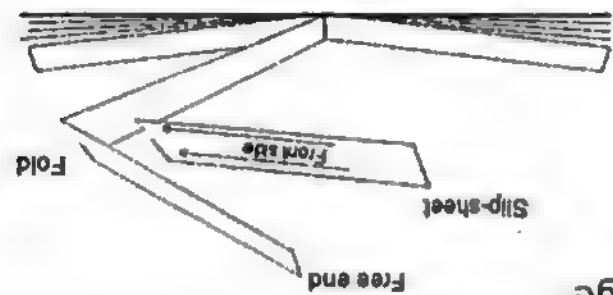
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Inverted Back

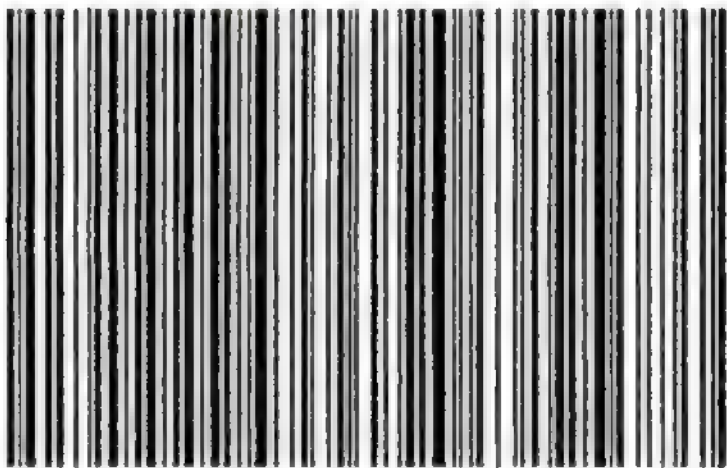
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1. Open the foldout page
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4. Close the page and slip-sheet



Foldout slip-sheet

GbsSlipSheet-001



Inverted Foldout slip-sheet

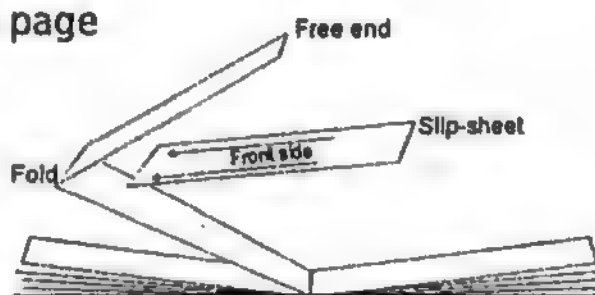
Open the foldout page

Insert this sheet with

1. Front side touching the free page
2. Arrow pointing to the fold

Slice the folded edge

Close the page and slip-sheet



smaller than many cases offering only five drive bays. Plus, we've also added a *second whisper-quiet cooling fan*. Why? Because the cooler a system runs the longer it will last. Now that's ZEOS Value. Speaking of which, here's another industry first you will definitely benefit from.

ZEOS ANNOUNCES: BUILT-IN SURGE SUPPRESSION!

Right now, ZEOS is proud to announce that we've taken our top-of-the-line *300 watt* supply and added a *built-in surge suppressor*. Building the surge suppressor right into the power supply increases reliability and helps protect your investment. We wonder how long it will take for the rest of the industry to catch up. And while ZEOS is giving you critically important features like these, we add yet another.

UL® Listing! As *PC Magazine* said, UL Listing is "one of the few forms of peace of mind you can buy." Every ZEOS system is Underwriters Laboratories Listed. This means your entire system (not just the power supply) has met the stringent

safety requirements of Underwriters Laboratories. Not only that, but your ZEOS UL listing says a lot about quality too. UL safety listings are something many of our competitors simply don't (or can't) provide you. At ZEOS quality and safety are important to us. *You are important to us!*

24-HOUR-A-DAY TOLL-FREE TECHNICAL SUPPORT.

The importance of having you as a customer shows in many other ways as well. For example, at ZEOS we believe supporting *you* should be more than a part-time proposition. As *PC Magazine* said, "Insist on a good service and support package. Expect...24-hour seven-day-a-week support." We've been saying that for years. In fact, it was ZEOS that invented *24-Hour-a-Day Toll-Free Sales and Technical Support*. Our customers tell us they love it. And you will too. Any time you need assistance, a ZEOS technician is only a phone call away.

With ZEOS you can have complete

Great Prices. L



**Now Pick 2:
Lotus 1-2-3 for
Windows, Ami Pro
2.0 and Freelance
Graphics!**

ZEOS COMPLETE SYSTEM PACKAGE #1

- The processor and speed of your choice plus future upgradability!
- 1MB of high-speed RAM, expandable to a system total of 32MB right on the motherboard.
- 42MB high-speed IDE hard drive with its own cache.
- 1.2MB or 1.44MB Teac® floppy drive.
- ZEOS 14" flat screen Hi-Res amber monitor with Tilt/Swivel Base.
- Shadow RAM and EMS support for enhanced performance.
- ZEOS/RS 101-key SpaceSaver keyboard.
- Two serial, one parallel & one game port built right onto the motherboard.
- 7-16, 1-8 bit expansion slots. 80387 math co-processor support for '386 systems.
- Rugged ZEOS SpaceSaver case with twin cooling fans for added reliability and product life.
- Seven drive bays and our custom 300 watt power supply with built-in surge suppressor!
- Includes ZEOS 24-Hour-a-Day Toll-Free Technical Support and Customer Satisfaction package.

INCREDIBLE ZEOS PACKAGE #2

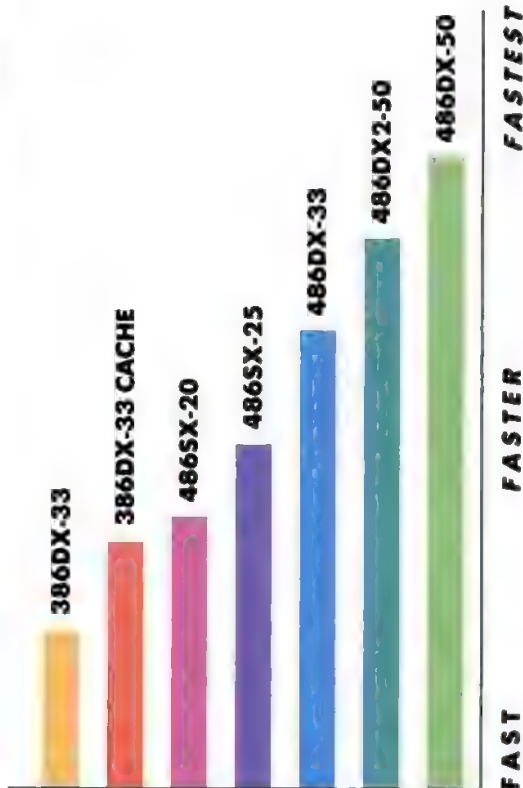
We take Package #1 and upgrade your ZEOS Modular System to include:

- 2 full Megabytes of rip-roaring RAM.
- Our incredible 107MB IDE hard drive with its own built-in cache.
- Both the Teac® 1.2MB and 1.44MB floppy drives.
- Diamond Stealth VGA card/1MB RAM & Sierra DAC plus WinRIX drawing software!
- ZEOS 14" High-Res VGA mono monitor with Tilt & Swivel Base.
- Microsoft Mouse, Microsoft Windows and DOS, plus 2 out of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro 2.0, and Freelance Graphics!

Now, ZEOS lets you pick exactly the power you want for the price you want to pay. Simply match the processor with the package configuration and you have your price. Or if you wish, we will custom build any system to your exact specifications.

And don't forget, with every ZEOS Windows System (packages 2, 3 and 4) you'll also receive your choice of 2 out of 3: *Lotus 1-2-3 for Windows*, *Ami Pro 2.0*, and *Freelance Graphics*. The Lotus software alone carries a suggested retail of over \$1,000 and even street prices are over \$700. Yet we're giving it to you at *no additional charge!* That's ZEOS value.

No doubt about it. ZEOS has broken the price/performance



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Let the "Z-Graphometer" help you pick the processing power that's right for you.

The comparisons are easy to make.

Fast, Faster or Fastest!

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Customize!
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Pick Your Power!

barrier with these great new upgradables, and you're the beneficiary. Incredible power, upgradability, and free software. What more could there be? From ZEOS, lots more.

Because your new ZEOS system is not only fast, it's absolutely loaded with features. Like our 300 watt power supply with *built-in surge suppression*, eight expansion slots, twin cooling fans for even more reliability, plus our unique seven-bay SpaceSaver case. And, every ZEOS system is UL® listed.

And don't forget you're also receiving 24-Hour-a-Day Toll-Free Technical Support, our 30-day Absolute Satisfaction Money-Back Guarantee, Express Parts Replacement and more. So go ahead.

Pick your Power, your Package, and your Price and give us a call. Your friendly, expert ZEOS Systems Consultant is ready to answer any questions you may have. *Call Now Toll Free 800-423-5891.*

PACKAGES 2, 3 AND 4 INCLUDE LOTUS BUNDLE!

	Pkg. #1	Pkg. #2	Pkg. #3	Pkg. #4
386DX-33	\$1395	\$1895	\$2395	\$2795
486SX-20	\$1495	\$1995	\$2495	\$2895
486SX-25	\$1595	\$2095	\$2595	\$2995
486DX-33	\$1695	\$2195	\$2695	\$3095
486DX2-50	\$1895	\$2395	\$2895	\$3295
486DX-50	\$1995	\$2495	\$2995	\$3395

Add \$200 to any price for a 128K cache.

PICK YOUR PAYMENT OPTION TOO:

When you buy from ZEOS you have a wide variety of payment options. We accept MasterCard, VISA, American Express and Discover cards, or if you wish we can ship COD.

We also have our own ZEOS credit card, the Z-Card®. The Z-Card allows you to charge your ZEOS purchases just like a MasterCard or VISA. There is a low consumer rate and there is no annual fee. We can send you an application or you can apply right over the phone. Our special toll-free application number is 800-421-8942.

ZEOS also offers a terrific leasing program for businesses. The rates are lower than those charged by most of the others in our industry. We will promptly mail or fax you an application on request. Just give us a call at 800-423-5891.

Purchase orders from Fortune 1000 companies, governments and institutions are subject to credit approval. Wire transfer is also available. Please call 800-423-5891 for details.

INCREDIBLE ZEOS PACKAGE #3

Add even more memory, a larger drive. And more savings! You now receive:

- 4 full Megabytes of ultra-high-speed RAM.
- Our fast 130MB IDE hard drive with built-in cache.
- Teac® 1.2 & 1.44MB FDD'S!
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- ZEOS 14" 1024x768 non-interlaced VGA Color monitor w/Tilt & Swivel.
- Microsoft Mouse, Microsoft Windows and DOS, plus 2 out of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro 2.0, and Freelance Graphics!

THE ULTIMATE ZEOS PACKAGE #4

Now, memory goes to 8MB and the drive to 210MB. PC Magazine Editors' Choice as a 486DX-33 Vertical!

- 8 full Megabytes of high-speed RAM.
- Your screaming 210MB IDE hard drive with its own built-in cache.
- Teac® 1.2 & 1.44MB FDD'S!
- Diamond Stealth Hi-Color VGA card/1MB RAM (32,000+ colors) plus WinRIX drawing software!
- ZEOS 14" 1024x768 non-interlaced VGA Color monitor w/Tilt & Swivel.
- Microsoft Mouse, Microsoft Windows and DOS, plus 2 out of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro 2.0, and Freelance Graphics!

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If you thought power like this was out of your budget, take another look. While many of the others don't even offer 50MHz power, *you can own the new ZEOS 486DX2-50 starting complete for as low as \$1895, or the full-blown 486DX-50 for as low as \$1995!*

Select from any of four money-saving

100+ megabytes; applications just don't seem to be shrinking (however, before you go too wild, remember you can always add more drives). Both of our Packages #3 and #4 incorporate these suggestions.

Certainly another option you may want to consider is our Vertical case. This heavy-

ZEOS POWER GRID FOR THE 486DX2-50

Apply The "Zeos Power Grid" To Match Your 50MHz Needs. Add \$200 for 128K cache. Prices shown are for Intel 486DX2-50 CPU; for 486DX-50 add \$100.

Pkg. #1 Only \$1895

Pkg. #2 Only \$2395

Pkg. #3 Only \$2895

Pkg. #4 Only \$3295

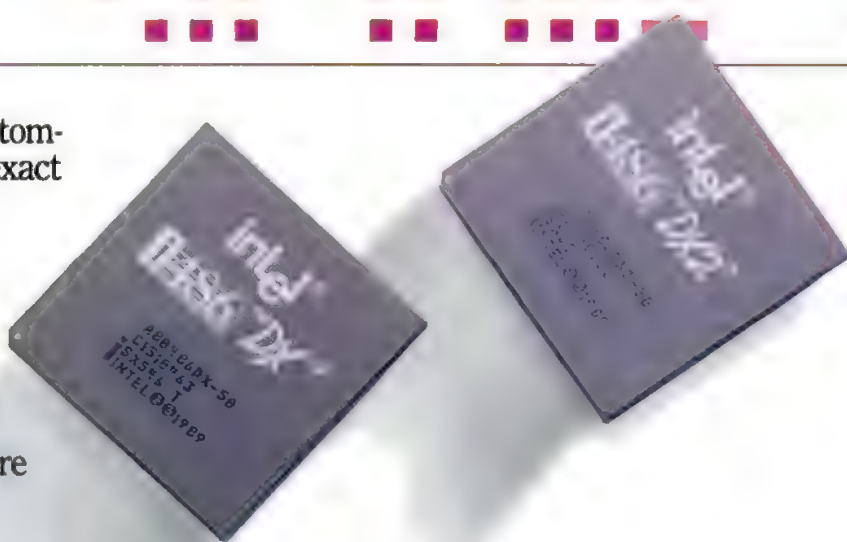
Intel 80486DX2-50MHz	Upgradable CPU	1MB High Speed RAM	2MB High Speed RAM	4MB High Speed RAM	8MB High Speed RAM	42MB HDD, Fast IDE	107MB HDD, Fast IDE	130MB HDD, Fast IDE	210MB HDD, Fast IDE	Teac L2 Floppy Drive	Teac L44 Floppy Drive	14" Hi Res TTL Monitor	14" VGA Mono Monitor	14" VGA Color 1024 x 768 NI	Monitor Tilt & Swivel	Hercules® Graphics Card	Hi-Color VGA Card, 1MB	Sierra DAC	Shadow RAM/EMS Support	ZEOS/RS 101 keyboard	2 serial, 1 parallel, 1 game port
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packages. Or, if you wish, let us custom-build your hot new 486-50 to your exact specifications.

WHAT SHOULD I GET?

How should you configure your new ZEOS 486-50? Of course the best answer depends on your needs and what you plan to use your new system for. But never before has so much power been available to everyone at such a low price. Our suggestion would be to consider investing in two areas when you buy your new 50MHz system. The memory and drives. Particularly the memory.

From what we're hearing, memory will be important with the new operating systems debuting later this year. We would strongly recommend at least 4 megabytes, eight if it's in the budget. As for drives, think in terms of



ZEOS 486-50

ZEOS Breaks the '486-

duty case holds more drives than most others and has a top-notch power supply and plenty of cooling.

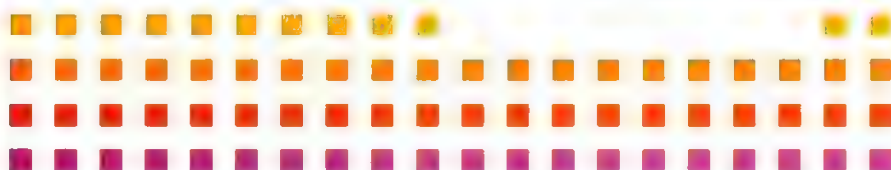
It really is quite a buy. The power supply is the *TurboCool 300 watt* unit (check the retail price of the power supply

alone if you really want to see what a good deal you're getting). It's well worth considering.

YOUR ZEOS EXTRAS. NO EXTRA CHARGE.

And don't forget, if you purchase a ZEOS Windows system we'll also include

746, 18 bit expansion slots
300 Watt Power Supply
Built-in Surge Suppression
ZEOS SpaceSaver Case
Two cooling fans
24-Hour Tech Support
System UL® Listed
FCC Class B
30-Day Money-Back Guarantee
1 Full Year Limited Warranty
Microsoft DOS
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Lotus 1-2-3 for Windows*
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*Your choice of 2

Consider the Vertical Option. We can build your new upgradable system in our eight bay vertical case. It comes complete with the 300 watt TurboCool power supply and two cooling fans. Add only \$150.

your choice of 2: *Lotus 1-2-3 for Windows*, *Ami Pro 2.0*, and *Freelance Graphics*. You'll be getting all the other ZEOS extras too.

If you don't go with the Vertical case, we'll send your 486DX2-50 in our seven-bay SpaceSaver case; it's complete with our top quality 300 watt power supply, *built-in surge suppressor*, and *two* whisper-quiet cooling fans.

Remember too, ZEOS also provides you with 24-Hour Support, our 30-Day Money-Back Guarantee, One Full Year Limited Warranty and our Express Parts Replacement Policy.

Ordering your new ZEOS is easy. Simply give us a call. You're going to love your new ZEOS '50. And that's a guarantee! Call now Toll Free 800-423-5891.

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1. Your order must be received by 1PM Central Time M-F.
2. Credit Cards are subject to authorization.
3. Orders must be for ZEOS '386 or '486 systems configured as shown here. Any other systems or upgrades are custom-built and will take slightly longer.

***OUR GUARANTEE TO YOU:**

If we accept your order for immediate shipment and fail to ship your system under the conditions outlined, we will ship it at *our expense* as soon as it is ready.

This offer is good only as long as these pre-built systems remain in stock; please give us a call to verify availability. This offer does not apply to other ZEOS systems or custom configurations.

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& No Annual Fee!

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Z-Card



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You can apply for your very own Z-Card and low, low monthly payments right now. Simply fill out the application below and fax it to 612-633-7507. Or mail it to ZEOS International, Z-Card Processing Center, 530 5th Ave. NW, St. Paul, MN 55112.

We'll contact you as soon as your credit line is established, usually within 24 hours of receipt. Apply today!

Apply for your own Z-Card today!

A. YOUR PERSONAL INFORMATION

Please complete all appropriate sections, providing at least two years residence and employment history. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This form must be signed to process your order.) All financed purchases are subject to credit approval. If you have any credit questions, please call 800-421-8942 for assistance. Thank you!

Name _____
Home Phone (_____) _____
Soc. Sec. No. _____ Date of Birth ____/____/____
Address _____ Apt. _____
City _____ State _____ Zip _____
Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____
City _____ State _____ Zip _____
Employer _____ Since? (Mo./Yr.) _____
Monthly Gross Salary \$ _____ Daytime Bus. Phone (_____) _____
Previous Employer _____ From _____ To _____
Occupation _____

A married person may apply for individual credit. I am applying for (please check appropriate box):
☐ **JOINT CREDIT** with another person. Complete entire application.
☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
☐ **INDIVIDUAL CREDIT**. Do not complete Section C.**
**If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income \$ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

Relationship _____

NOTICE TO WISCONSIN APPLICANTS:
YOU MUST DISCLOSE YOUR MARITAL STATUS:
☐ married ☐ unmarried ☐ legally separated

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE A:

Checking Account	☐ Yes ☐ No		
Savings Account	☐ Yes ☐ No		
	Y/N	How Many?	Y/N How Many?
Bank Loan	_____	_____	Dept. Store Charge Card _____
VISA	_____	_____	Credit Union Account _____
MasterCard	_____	_____	Other Major Charge Cards _____
Finance Company Loan	_____	_____	

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____
Soc. Sec. No. _____ Date of Birth ____/____/____
Address _____ Apt. _____
City _____ State _____ Zip _____
Home Phone (_____) _____ Date of Residence (Mo./Yr.) _____
Joint Applicant's Employer _____ Since? (Mo./Yr.) _____
Bus. Phone (_____) _____ Monthly Gross Salary \$ _____

CUSTOMER AUTHORIZATION

I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief.

Applicant's Signature _____

Date _____

Joint Applicant's Signature _____

Date _____

FOR MARRIED WISCONSIN APPLICANTS: I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

Buyer's Signature _____

Date _____

There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 800-421-8942 or 612-635-0613 or write to ZEOS, Z-Card Processing Center, 530 5th Avenue N.W., St. Paul, MN 55112.

NY — A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

OH — The Ohio laws against discrimination require that all creditors make credit equally available to all creditworthy customers and that credit reporting agencies maintain separate credit histories on each individual upon request. The Ohio Civil Rights Commission administers compliance with this law.

*Financing not available in Alaska, Hawaii or outside the continental U.S.

Z-C/IJ

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CIRCLE 115 ON READER SERVICE CARD

hand. The direct marketing company with the most outrageous ads (Robin Hood and Radio City, for example) earned the most positive response toward any manufacturer when we asked users if they would consider buying the same brand again. In fact, Gateway's score of 9.02 out of a possible 10 was significantly higher than Zeos International's second-place rating of 8.58. Gateway PCs also scored significantly above average for reliability (9.13 versus the 8.51 average), repair experience (8.73 versus the 7.93 average), and technical support (8.44 versus the 7.48 average).

The full range of Gateway's desktop line, from 286s through 486s, was represented in the survey. In the 286 category, each system score was significantly higher

than the average. The same was true for the 386SX and 386 categories, except in one instance: Satisfaction with 386SX-line repair experience was average. Users rated the likelihood of buying another 386-based Gateway a whopping 9.07, far above the 7.05 average.

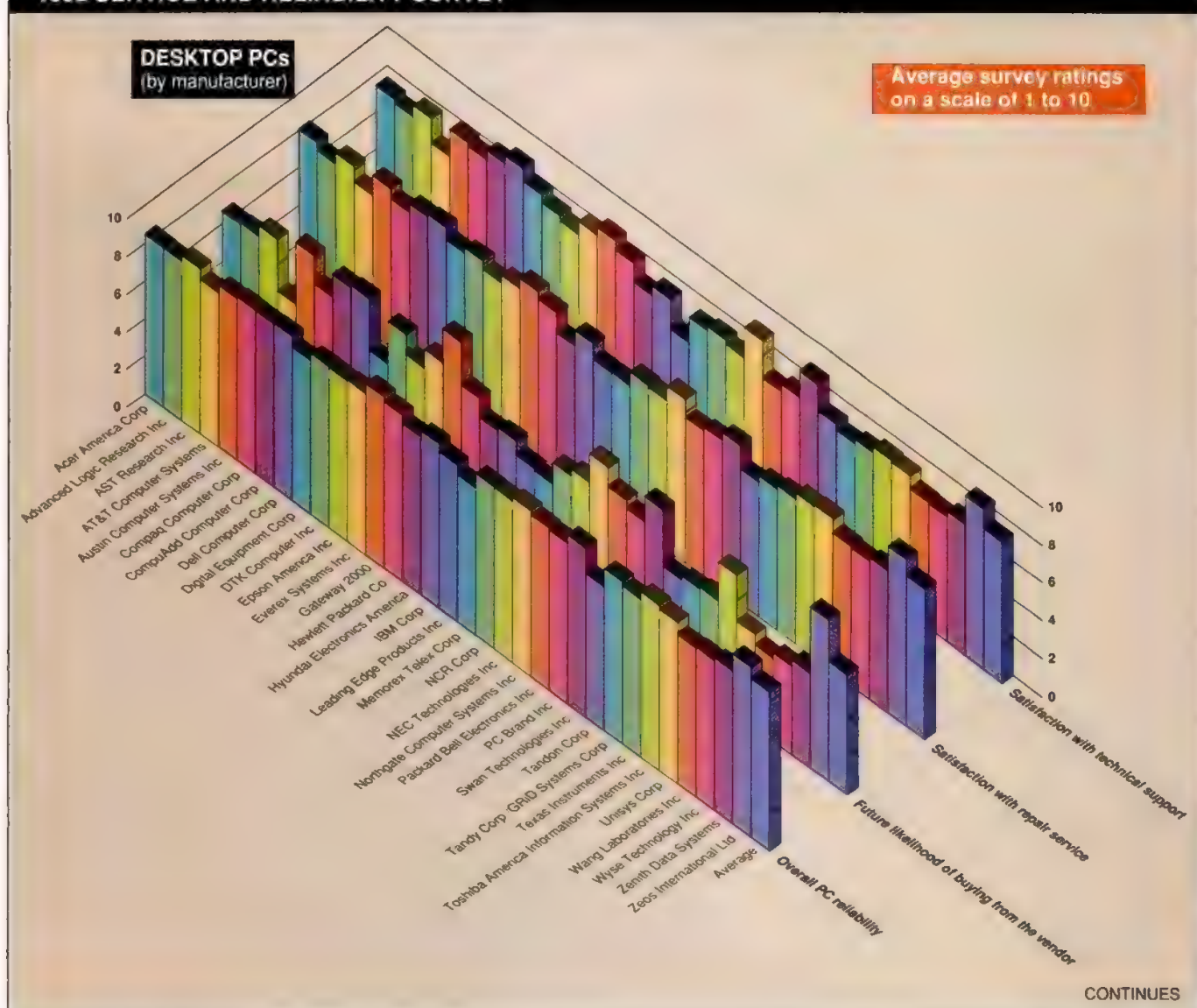
The 486 line had average scores in every category except future buying plans, where once again Gateway topped the rankings (9.28 versus the 8.30 average).

Gateway also ranked well above average for reliability in every category of component, from motherboard and video graphics board to monitor, keyboard, and power supply.

Gateway's impressive scores can be

attributed to its focused approach to support and free on-site service through TRW during the one-year warranty period. The company claims to have 200 technicians available for toll-free phone support. They are divided into five specialties: networking, video subsystems, hardware, software, and general systems. Hours are weekdays from 6:00 A.M. to midnight C.S.T and Saturdays from 9:00 to 2:00. Users can also fax their questions, use the Gateway bulletin board, or connect to CompuServe, Prodigy, GENie, and BIX (Byte Information Exchange). In addition to its standard support, Gateway has a large corporate program with a separate toll-free phone number and a dedicated order-entry technician to ship parts. One shortcoming in the support is that users

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cannot extend the service after the warranty expires. The level of loyalty indicates that Gateway's sales pitch extends beyond the giant ads.

FACT FILE

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HEWLETT-PACKARD CO.

by Henry Fersko-Weiss

Hewlett-Packard Co. has long been a brand-name PC manufacturer with a good reputation for service and reliability. Our survey tends to confirm this: HP scored significantly above-average ratings in all four key categories. Its PCs received a reliability rating of 8.87 (versus the 8.51 average), and the likeliness of users buying from HP again in the future rated 6.76 (versus the 6.42 average). Their satisfaction with repair experience rated an 8.33 (versus the 7.93 average), and they gauged their satisfaction with technical support as a 7.95 (versus the 7.48 average).

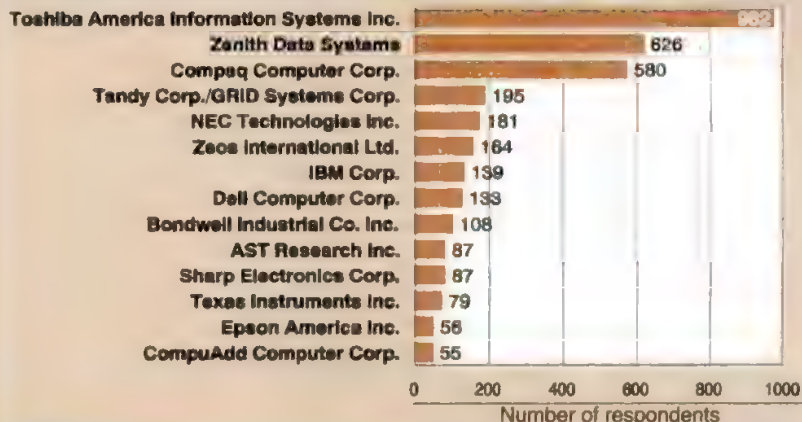
When reliability scores for components were evaluated by manufacturer, HP again ranked significantly above average in all categories except internal modems, which had an average score. In its 386 product line, the motherboard, video graphics board, monitor, and keyboard were ranked significantly above average for 386 computers; scores for the other components were within the average range.

HP computers represented in the survey included 286, 386SX, 386, and 486 models. Scores for the 386SX PCs fell within the average range, while 386 scores for reliability, satisfaction with repair, and satisfaction with technical support were significantly above average. Yet users rated the future likelihood of buying an HP 386 as only average—possibly because of the price premium HP extracts. There were not enough responses to our questions about HP's 486 machines to compare them against those of other manufacturers.

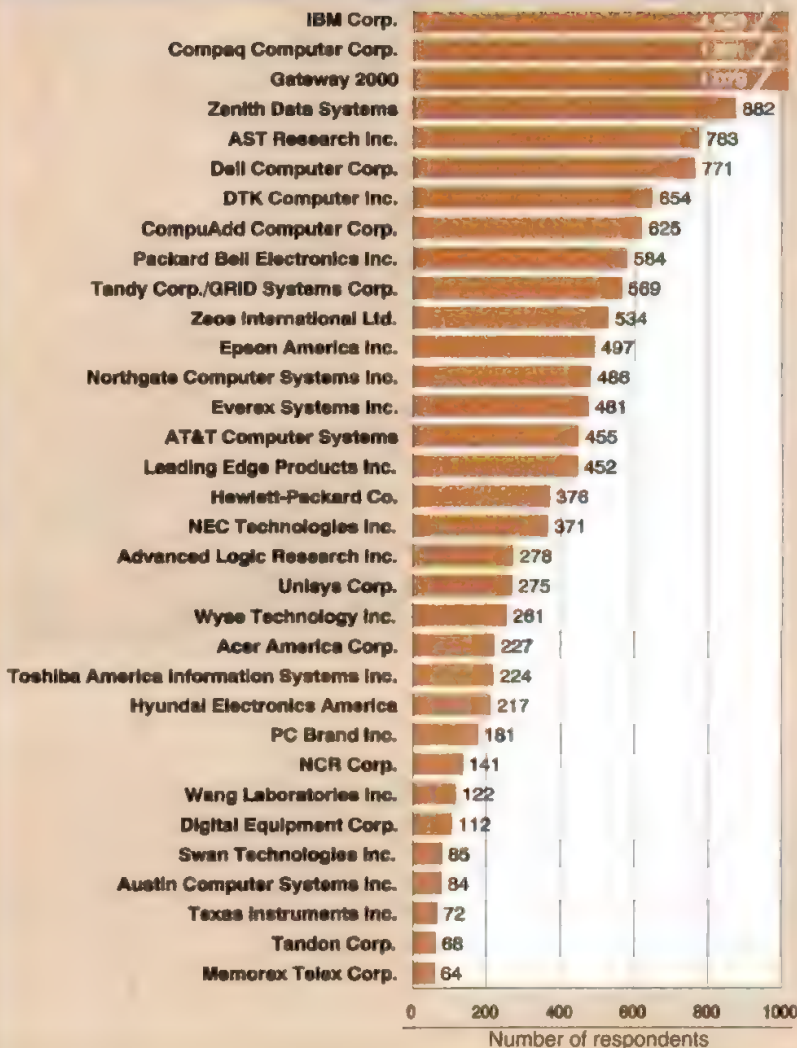
HP sells only to dealers, but it will service all models except 486 PCs under its standard one-year carry-in warranty.

1992 SERVICE AND RELIABILITY SURVEY

LAPTOPS AND NOTEBOOKS (by manufacturer)



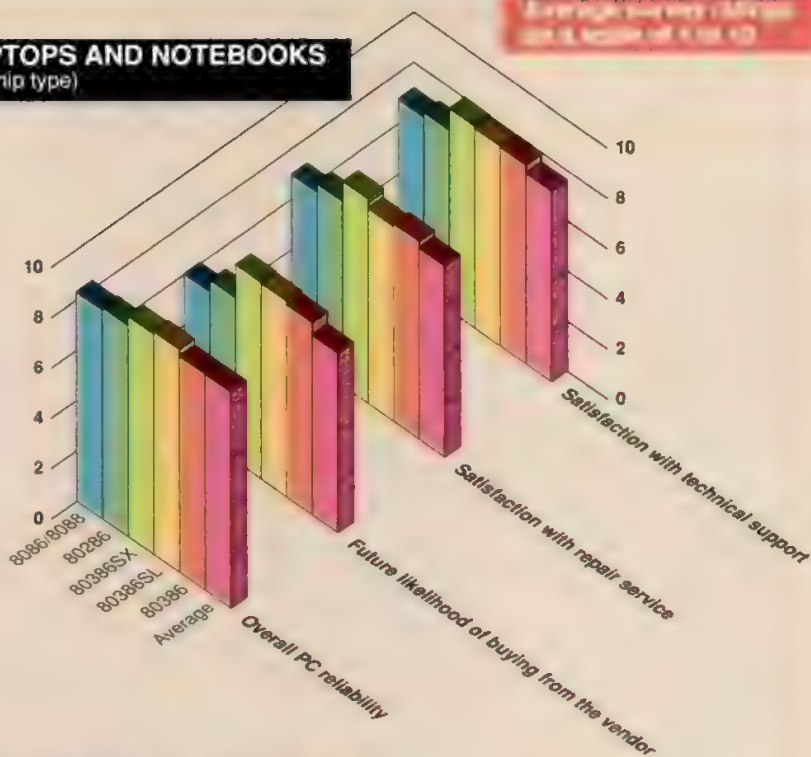
DESKTOP PCs (by manufacturer)



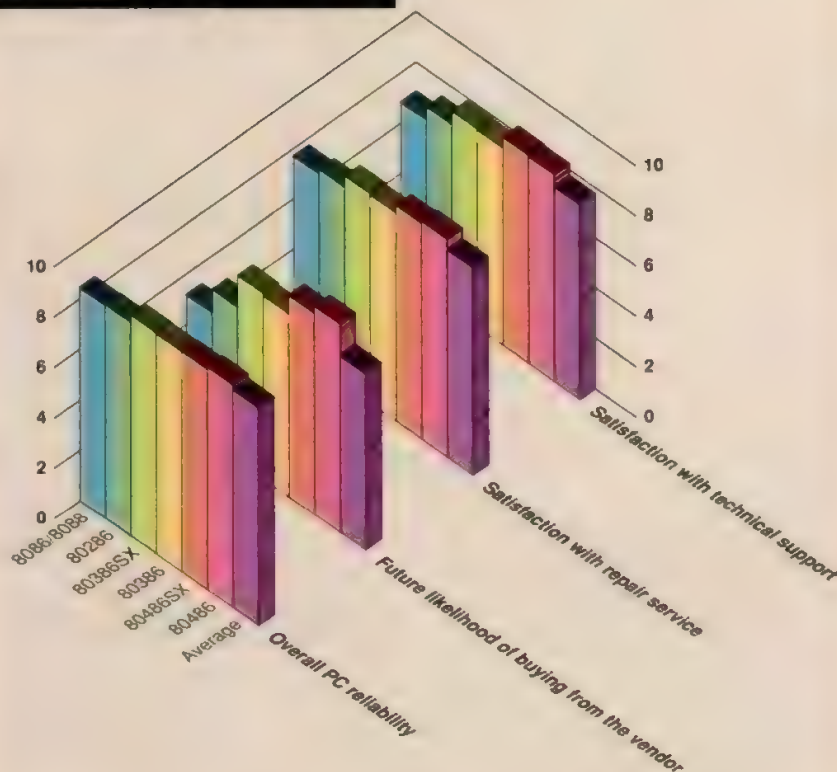
CONTINUES

1992 SERVICE AND RELIABILITY SURVEY

LAPTOPS AND NOTEBOOKS (by chip type)



DESKTOP PCs (by chip type)



Many users receive service from an authorized dealer. Dealers may also subcontract back to HP, in which case HP will send a technician to the dealer once a week to do repairs. Toll-free technical support is available weekdays from 7:00 A.M. to 8:00 P.M. P.S.T.

The 486 PCs come with free on-site service for the one-year warranty period and is handled by HP or an authorized dealer. A user can buy one of three upgrade options to the on-site service: 4-hour response time during normal business hours; Priority Plus, a 4-hour response service available 24 hours a day, 7 days a week; or a large-account service that lets users schedule regular on-site visits. The costs vary by model, configuration, and dealer, but as an example, standard 4-hour service from HP for a Vectra 486 Model 1 (25-MHz with 2MB of RAM) would cost \$672.

Any user can extend warranty service with an on-site contract. Costs vary. For example, HP charges \$240 for a one-year standard on-site contract for its Vectra 386/25 with 2MB of RAM.

HP systems and system components scored significantly above average in almost all the reliability categories. Its 24-hour 7-day technical support and great variety of on-site services give users a great deal of comfort—in some cases, enough to overcome the premium costs.

FACT FILE

Hewlett-Packard Co., 3000 Hanover St., Palo Alto, CA 94304; technical support, 800-633-3600; sales, 800-752-0900; fax, 800-865-6860.

CIRCLE 501 ON READER SERVICE CARD

HYUNDAI ELECTRONICS AMERICA

by Henry Fersko-Weiss

Hyundai Electronics America recently began offering—for a limited time only—a *lifetime* warranty on parts and service with the purchase of one of its PCs. This stunning promotional offer was meant to demonstrate the company's new focus on service and support. But our survey results show that Hyundai, owned by the same Korean conglomerate that makes those economy cars, will have to do more than offer free repairs forever to

ENDS

FACT FILE

win devoted customers. Although Hyundai's scores for reliability (8.43 versus the 8.51 average) and technical support (6.98 versus the 7.48 average) fell within the average range, users were more negative about their experience with Hyundai's repair services (7.27 versus the 7.93 average). This may have contributed to their below-average enthusiasm for buying another Hyundai system (5.75 versus the 6.42 average).

Hyundai sells its computers through dealers. When the company started selling computers in the U.S. four years ago, it introduced an 18-month warranty—the longest in the industry. Since that time, a number of other manufacturers have matched and surpassed that policy. Hyundai has tried to gain the high ground with its lifetime warranty. Until June 30, 1992, the warranty will be provided free with all systems. When the promotion ends, the company will again offer the 18-month warranty, but users can buy the lifetime extension for an amount not yet determined (probably for less than \$200).

The standard warranty requires users to bring the computer to a dealer or mail it to Hyundai. The company has about 2,000 dealers and six regional service centers. Around 10 percent of those dealers belong to a group that Hyundai calls TEAM (Technical Excellence Authorized Members), which guarantees 24-hour turnaround on all repairs. TEAM dealers get special breaks from Hyundai for their efforts.

Users can also purchase an on-site warranty for \$100 to \$200, depending on the dealer. At present, the on-site service comes from TRW. Users within 50 miles of a TRW location are guaranteed service within 24 hours.

Since Hyundai sells strictly to dealers, it targets its technical support to dealers rather than end users. But Hyundai maintains a toll-free technical support line that accepts user calls between 8:00 and 5:00 P.S.T.

Hyundai's big concern should be its below-average ratings for satisfaction with repairs and future buying plans. The offer of a lifetime warranty may help turn these ratings up, but the company may need to fix more than the length of the warranty.

Hyundai Electronics America, 166 Baypointe Pkwy., San Jose, CA 95134; sales, 800-627-7978.

CIRCLE 502 ON READER SERVICE CARD

IBM CORP.

by Edward Mendelson

One of the oldest maxims in the computer world says that no one ever got fired for buying IBM. To judge from the opinions of *PC Magazine's* readers, IBM rates among the leaders in terms of service and reliability. But despite its high ratings in these categories, IBM scored significantly lower than average when respondents rated the likelihood of buying from IBM in the future.

Our survey shows that IBM users report significantly higher reliability for their machines (8.74 versus the 8.51 average) and satisfaction with their repair experience (8.10 versus the 7.93 average), although their satisfaction does not reach

the heights reported by owners of top-rated mail-order machines such as those from Gateway 2000 and Zeos International. IBM computers won significantly high reliability ratings for its motherboards, graphics boards, keyboards, and

power supplies. Hard disks and internal modems were rated as average, but the ratings for monitors and floppy disk drives were significantly below average.

Some of the variations in the IBM scores may reflect the company's long history in the PC market. Users of IBM 8088/8086 machines owned their computers longer than users of any other brand, presumably because IBM sold these machines years before anyone else. The age of these machines may account for the significantly low reliability scores received by their hard disks, video cards, and power supplies.

The most recent IBM machines, powered by 386 and 486 chips, fared some-

what better, usually with reliability and service scores that were average or higher for both desktops and laptops, as well as for individual components. But these machines also received worse-than-average ratings on the question dealing with respondents' future likelihood of buying another IBM PC again.

The service you get for an IBM machine depends partly on the dealer you buy it from. IBM has a general warranty that covers one year on parts and labor, but the individual dealer determines who pays shipping and whether you will get on-site service.

BUREAUCRACY AT IBM

One potential advantage—and potential frustration—of buying from IBM is that you have access to an enormous bureaucracy that maintains spare parts for machines that IBM no longer sells. For example, if you call IBM's main 800 number, you can find out how to reach a parts-identification service that is expert enough to tell you the part number of something you can identify only as "that black plastic doohickey next to the power supply." You can then call another IBM phone number and order the part directly. (By the time you read this, IBM should have installed a centralized customer satisfaction program called HelpWare. One element of it is a toll-free HelpCenter, staffed entirely by IBM personnel, designed as a safety net for customers who don't know where to find technical support, and as a means of arranging service for any problem with IBM machines. None of the above-mentioned support information was available at the time of *PC Magazine's* survey.)

Why are so many of IBM's customers less than willing to buy again from IBM? It is possible to guess at some reasons: perhaps IBM's relatively high prices, or maybe the cost and rarity of add-in cards for the MCA. All that *PC Magazine's* survey reveals is that IBM's customers like their machines, but they are not overwhelmingly likely to buy more from the same source.

FACT FILE

IBM Corp., 1133 Westchester Ave., White Plains, NY 10604; technical support, 800-426-7378; sales, 800-772-2227.

CIRCLE 503 ON READER SERVICE CARD

Variations in

IBM's scores may reflect

the company's long history

in the PC market.



👁️ I've been using WordPerfect® since my company was just me and my old XT, and I've grown rather attached to it over the years. 🖋️ I know "character-based" programs are out of fashion right now, but I'm sorry. Writing is still character-based, and so am I. 🖨️ WordPerfect is the fastest way I know to get the job done right. ✂️ If you're all excited about Windows, fine. You can have my copy.

WordPerfect

LEADING EDGE PRODUCTS INC.

by Edward Mendelson

Leading Edge Products has been in the PC business almost as long as IBM. Not surprisingly, our survey produced more responses from users of Leading Edge's 8086/8088 and 286 machines than for the more powerful models. Keep this in mind when interpreting Leading Edge's scores, because the results include machines with older technologies and have had more time to develop problems. The original Leading Edge computers were made by the Korean firm, Daewoo Telecom Co., which now owns Leading Edge and makes the computers as well.

Survey respondents gave Leading Edge scores that fell within the average range for reliability (8.32 versus the 8.51 average), but their future likelihood of buying another PC from this company (5.14 versus the 6.42 average), satisfaction with repair experience (7.25 versus the 7.93 average), and satisfaction with technical support (5.88 versus the 7.48 average) were all below average. Ratings for hard disks (8.13 versus the 8.51 average), monitors (8.45 versus the 8.78 average), and keyboards (8.64 versus the 8.87 average) were all significantly below average, although scores for the other components did not differ significantly from the averages for their respective categories.

Leading Edge's dealers are the primary source of support, and customers don't deal directly with the manufacturer for purchases or repairs. On-site service is offered through GE Computer Service: The first six months are free, and the next six months cost \$39.95.

You can call Leading Edge directly for technical support on either an ordinary toll line or a \$2-per-minute 900 number. The ordinary toll call puts you into a queue, while the 900 number is designed to get you to a technician quickly. If your problem needs more than 2 or 3 minutes on the 900 line, the technician will generally call you back.

Leading Edge took a more active service role late in 1991 after it inadvertently shipped some machines (fewer than 500) whose hard disks were infected with the Michelangelo virus. As soon as Leading Edge learned about the infection, it notified its resellers and sent technicians to the resellers to destroy the virus. Customers who had sent in the warranty card

received a warning notice and a copy of McAfee Associate's *VirusScan* software to detect the virus and remove it.

Service centers also received copies of *VirusScan*, and resellers were asked to give Leading Edge the names of customers so that the company could contact those who failed to send in the card. Leading Edge endured a computer vendor's nightmare and did its best to keep its customers from suffering nightmares of their own.

FACT FILE

Leading Edge Products Inc., 117 Flanders Rd., Westborough, MA 01581; technical support, 900-370-4800, 508-836-4800; sales, 800-874-3340; fax, 508-836-4507.

CIRCLE 504 ON READER SERVICE CARD

MEMOREX TELEX CORP.

by Michael Cohn

Memorex Telex Corp., an agglomeration of two renowned brands in the electronics industry, earned respectable grades for its repairs and technical support, but its scores in other areas indicate that venerable names can only carry you so far in the PC business.

Our survey put user satisfaction with repairs at 7.28 (versus the 7.93 average) and technical support at 7.23 (versus the 7.48 average)—decent, average scores. The significant disparities showed up when users were asked about overall reliability and their likelihood of buying the same brand in the future. On reliability, Memorex Telex machines garnered a rating of 7.81, significantly below the 8.51 average. Users had serious doubts about buying from Memorex again: The score of 5.02 was well short of the 6.42 average.

When Memorex Telex desktops were rated on reliability of individual components, video graphics boards came in at 8.29, significantly below the 8.93 average. Hard disks, whose rating came to

7.71, were also significantly below the 8.51 average. The scores for other components fell within the average range.

Sensitive to its problem areas, Mem-

orex Telex has organized focus groups to survey its customer base and is using their suggestions in its planning. On the basis of responses culled from these groups, it has decided to provide a clearer upgrade strategy, a more comprehen-

sive product line, better company visibility, and improved quality control.

Memorex Telex has also modified its approach toward manufacturing and service. The company has reduced the number of parts suppliers it uses to ensure better quality control and has begun manufacturing more of its PC products in-house. It has changed its sourcing strategy for hard disks, using only major, proven suppliers. Memorex Telex says that it has made its tests of incoming parts more stringent and has enhanced testing procedures for compatibility, parts integration, and stress. It also performs more inspections on the final product.

Service is another area that Memorex Telex says it has improved. The company claims its biggest strength is its large multinational service force. Memorex Telex provides system integration for groups of users, same-day service for critical components, and a toll-free technical support number. If telephone support is not enough to resolve a problem, the company automatically dispatches a repair person to the customer's site without requiring a second phone call. Upgrades for desktop machines arrive with a Memorex Telex representative to install them. In a move unusual for the industry, the company will also train self-maintainers at a customer site.

The parts-and-labor warranty lasts one year and includes free on-site service. Shipping charges do not apply since Memorex Telex performs its servicing at the customer's site. Most of its warranty extensions last two years, and the cost varies. The company guarantees service on laptops for \$99 per year anywhere in the world. There is no formal money-back guarantee, but Memorex Telex says trial periods are not uncommon.



✎ I was so hyped for Windows I couldn't wait to get the last of the DOS programs off my hard disk. Except I kept starting documents in Windows, only to give up and go back to WordPerfect*. ✌ Then when WordPerfect shipped their Windows version, it was like going home for me. ☺ In theory, one Windows program should feel pretty much like the next one. In practice, the only one that feels right to me is WordPerfect.

WordPerfect

FACT FILE

Memorex Telex Corp., 545 E. John Carpenter Freeway, Irving, TX 75062; technical support, 800-950-3465; sales, 214-444-3500; fax, 214-444-3501.

CIRCLE 505 ON READER SERVICE CARD

NCR CORP.

by Wendy Dugas Pérez

NCR Corp. began life as the National Cash Register Co. 107 years ago in Dayton, Ohio. When AT&T began a hostile takeover in 1991, NCR was still making cash registers—and a lot of other products, including ATMs and computers. Now wholly owned by AT&T, NCR has retained its name and remains a separate company with its own board of directors. It supplies service and support for AT&T's products as well as its own.

Our survey respondents put NCR in the average range, indicating general satisfaction with the company's service and support. PC reliability was calculated at 8.58, close to the 8.51 average for desktop systems. Figures for future likelihood of buying again from this company (6.17 versus the 6.42 average), satisfaction with repair experience (8.01 versus the 7.93 average), and satisfaction with technical support (7.45 versus the 7.48 average) were also solidly in the middle range. Reliability ratings for individual components were average across the board except for the internal modem category, which at 9.64 stood significantly above the 9.13 average.

Although a small portion of NCR's sales are direct, most come through dealers. Consequently, NCR expects users to turn to dealers for support. NCR's standard warranty covers one year of depot service from its dealers, although systems under this warranty are eligible for NCR's on-site service at an extra \$40 during the first year. The cost of on-site service after that depends on the system.

NCR charges for other services as well. Telephone support and BBS access are toll-free but are available only under a maintenance contract whose cost depends on the system model and configuration. You can, however, continue to purchase maintenance contracts for as long as you need.

NCR's slogan boldly states: "We take

COVER STORY

SERVICE AND RELIABILITY

customer satisfaction personally." Despite the extra cost for some of the services, our survey results suggest that so far, users have been reasonably satisfied with the quality.

FACT FILE

NCR Corp., 1700 S. Patterson Blvd., Dayton, OH 45479; sales, 800-225-5627; fax, 513-252-9541.

CIRCLE 506 ON READER SERVICE CARD

NEC TECHNOLOGIES INC.

by Kellyn Betts

PC Magazine readers are more likely to have the letters NEC inscribed on their monitors than on their laptops or PCs. Still, desktop and laptop systems from this Japanese company have proven popular enough to be included in our survey.

NEC's scores for desktop systems turned out to be higher than for its laptops. In our four key categories, NEC's desktop machines earned solid, average scores: 8.55 for PC reliability, 7.91 versus the 7.93 average in terms of repair service, 7.18 versus the 7.48 average for technical support, and 6.54 versus the 6.42 average for the likelihood of buying an NEC PC in the future. NEC's scores on the reliability of individual components were also average.

Users of NEC laptops were less pleased. The scores they submitted put NEC at 8.28 versus the 8.59 average for reliability, 7.27 versus the 7.59 average when it came to satisfaction with repair experience, and 7.00 versus the 7.52 average for satisfaction with technical support—still average but in the lower part of the range. On the likelihood of buying from NEC again in the future, a key indicator of a manufacturer's lasting power, NEC laptops scored 5.81, significantly below the 6.87 average. These scores, however, reflect experience with the early 8086/8088 NEC UltraLites and 286-based ProSpeeds. Neither processor class is still on the market, and perceived deficiencies in these products may help account for these low ratings.

NEC's service-and-support policies have not changed significantly since the

survey. Warranties are good for a year. Service is provided solely through dealers that are authorized by NEC to perform repairs. On-site service through NEC and GE Computer Service is available but costs extra. In addition, individual dealers may offer special extra-value service, but no corporatewide policies regulate such matters.

NEC has indicated it will revamp its policies for support of laptops in a way that really favors the user. Unfortunately, specific details were unavailable when we went to press.

NEC maintains a toll-free customer support line weekdays from 8:30 to 7:00 E.S.T. and a separate line for dealers. The company also operates a toll-free automated fax service called FastFacts and an end-user BBS that requires a toll call.

NEC was forthright about the potential disadvantages of its dealer service policy, admitting that some dealers were on the ball and others weren't. The company is trying to improve the general level of service quality by weeding out dealers who generate too many user complaints.

Despite policies that have been less than endearing to PC customers, NEC has managed to garner a respectable rating. A more vigorous laptop plan stands to add a lot of appeal.

FACT FILE

NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; technical support, 800-366-3637; sales, 800-388-8888; fax, 800-366-0476.

CIRCLE 507 ON READER SERVICE CARD

NORTHGATE COMPUTER SYSTEMS INC.

by Kellyn Betts

Northgate Computer Systems has been a service leader since 1987, when Art Lazere, the firm's flamboyant chairman, founded this mail-order company. Among the first to develop innovative approaches to service, Northgate quickly became known for extending itself to please its customers. And it is continually upping the ante: Northgate introduced round-the-clock telephone support in May 1991. This dedication to service seems to have paid off; Northgate



✍ With our current license, we can run WordPerfect® for DOS, Windows or OS/2 — or all three — on the same machine. And WordPerfect for Presentation Manager will be a simple upgrade. ☎ My own feeling is, OS/2's going to blow the doors off the industry. It's a clean sheet of paper, not a thing on a thing like Windows. ☺ But however the operating systems shake themselves out, WordPerfect will still be the word processor of choice. You just know it.

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These days, it seems just about anyone can make and sell computers. But only one company has a way to give you more—service and support unmatched by anyone else in the industry. It's called HelpWare,[™] and it's yours with every IBM PS/2[®] computer.

HelpWare is a whole new way of working with IBM. It's with you every step of the way—before you buy a PS/2, while you're using it, even when you're ready to move on to more powerful models. It's a new number to call with your PC questions, a new 30-day quibble-free return policy, new education centers, new trade-in and lease plans, plus a host of other offerings for PS/2 and OS/2.[®] In short, HelpWare is total customer satisfaction—the most and best service and support you can get.

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Introducing IBM HelpWare for PS/2.

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- A host of other offerings available, yours with every PS/2.

CIRCLE 024 ON READER SERVICE CARD

IBM[®]

earned the highest score for satisfaction with technical support among this survey's 35 desktop manufacturers.

The service behind Northgate's technical support is equally impressive. Free on-site service is guaranteed weekdays for the year the computer equipment is under warranty. If you report a problem on a Saturday, Northgate may even manage to get one of its NCR service representatives into your office that day to fix it.

Not surprisingly, this hyperresponsive service earned Northgate very high scores on all four key areas for manufacturers. PC reliability, at 8.75, was significantly higher than the 8.51 average, as were the figures for satisfaction with technical support (8.82 versus the 7.48 average) and with repair experience (8.69 versus the 7.93 average). It was no surprise that when asked whether they would buy a Northgate PC again, our survey respondents showed solid enthusiasm: Northgate's 8.06 score was significantly higher than the 6.42 average.

Northgate scored significantly above average in reliability for its hard disks, floppy disk drives, monitors, video graphics boards, keyboards, and internal modems. The motherboards and power supplies received average ratings. In subcategories by processor class, Northgate's 386-based computers received ratings that were either average or significantly higher than average. On satisfaction with technical support, Northgate's 486-based desktops received a score of 9.14, a significantly higher rating than those of the other 486 manufacturers: Compaq, Gateway 2000, IBM, Northgate, and Zeos.

At present, Northgate's arrangement with NCR gives users access to on-site service from nearly 500 centers in the U.S. and Canada. But the company will repair computers itself if need be. In such situations, Northgate determines turnaround time on a case-by-case basis and mirror-ships the unit back. It also offers warranty extensions and several higher levels of service; the most expensive guarantees on-site service within 4 hours.

FACT FILE

Northgate Computer Systems Inc., 7075 Flying Cloud Dr., Eden Prairie, MN 55344; technical support, 800-446-5037; sales, 800-548-1993; fax, 612-943-8338.

CIRCLE 508 ON READER SERVICE CARD

PACKARD BELL ELECTRONICS INC.

by Kellyn Betts

Packard Bell Electronics customers want the human touch—and an informed one at that. That's one way to interpret the mixed reviews for a company that sells primarily through superstores, price clubs, and other retail outlets and whose market includes a large segment of home users.

Packard Bell's computers earned average ratings in terms of reliability (8.57 versus the 8.51 average) and on satisfaction with repair experience (7.76 versus the 7.93 average). But technical support did not measure up: Its 6.88 score was significantly below the 7.48 average. Despite this unhappiness, users said they would likely buy another machine from the same company (7.05 versus the 6.42 average).

Customers first encounter Packard Bell's technical support via a recorded message service called Infinitech. Although Infinitech is on a toll-free line, it forces you to press your way through layer after layer of menus recorded over a considerable amount of background noise. These menus require you to specify sales or support, the general nature of the advice you need, the specific nature of this advice, the general class of machine, the specific model, and much more before you are treated to anything remotely resembling help.

When we finally did reach a technician, some of the information we were given was out of date and some of the installation advice less thorough than it ought to have been. Packard Bell promises to fix these little problems in its tech support services, but customers will still have to pay phone charges for the opportunity to speak to human beings between the hours of 5:00 and 9:00 P.S.T. If you don't want to listen to a recording, you can either place a toll call to the company's BBS and leave a message or contact Packard Bell through Prodigy or CompuServe.

Packard Bell's service options are just as varied but more generous. The company backs its industry-standard one-year warranty by on-site service through a network of more than 250 authorized independent service centers, many of which double as Packard Bell dealers.

Customers too far from these centers or unwilling to wait (Packard Bell promises service in 24 to 72 hours of the initial call) can mail their units in. If you send your certifiably troubled Packard Bell PC to the company's headquarters in Chatsworth, California, the company will pick up the postal tab if you did not send it by overnight shipping.

At nearly all processor levels covered in our survey, Packard Bell customers were dissatisfied with the company's technical support. Ratings in that category for 286-based machines were tallied at 6.34, significantly below the 7.28 average. For 386SX PCs, the figure was also outside the average range: 7.28 versus the 7.84 average. In the 386 class, the 7.49 score was not significantly lower than the 7.72 average.

Packard Bell users tell us they are more likely than other users to purchase Packard Bell products again. But they would be a lot happier if the company rose to industry standards and offered toll-free technical support lines staffed with people, not tape. Infinitech is fine for off-hours and easy questions, but the automated systems need to be teamed with human support.

FACT FILE

Packard Bell Electronics Inc., 9425 Canoga Ave., Chatsworth, CA 91311; technical support, 800-733-4411, 818-886-2098; sales, 818-886-4600; fax, 818-773-9558.

CIRCLE 509 ON READER SERVICE CARD

PC BRAND INC.

by Greg Pastrick

PC Brand, a direct marketer noted for its aggressive pricing, registered scores that fell within the average range on our survey's four key categories. PC reliability was put at 8.48 compared with the 8.51 average, the future likelihood of buying again from this company scored 6.62 compared with the 6.42 average, satisfaction with repair experience was calculated at 7.94 compared with the 7.93 average; and satisfaction with technical support came out to 7.26 versus the 7.48 average.

Similarly, when PC Brand's product line was surveyed for the reliability of

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STANDARD 200XT \$69

Economical This UL approved, fully tested unit is one of the best generic 200s available. Costs no more than our Standard 150 it replaces.

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Ultra-Quiet Stop that irritating noise with the Silencer 200. Its large, low speed, German fan keeps your system 5° to 15° cooler and 84% quieter. Virtually inaudible! Great in the executive suite or home office.

TURBO-COOL 200 \$159

High Performance Put AT power and 200% more cooling under the hood of your PC/XT with our UL approved Turbo-Cool 200. Its patented twin fan, sloped-cover design keeps your system 30° to 45° cooler, preventing data errors and other heat-related problems. Perfect for hot rod PCs and Mini ATs!

TURBO-COOL 300S \$169

Slim and Powerful Give your Slimline or Mini-Tower computer up to 100% more power and cooling with our low profile, direct replacement Turbo-Cool 300S. With a peak capacity of over 350 watts, it will easily start even the largest hard drives and peripherals!

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AT/TOWER

STANDARD 220 \$99

Economical This UL approved, fully tested unit is one of the best generic 220s available. Ideal for basic systems.

SILENCER 220 \$139

Ultra-Quiet Unrattle your nerves with the Silencer 220. Its custom, *thermostatically-controlled* fan maintains the correct system temperature while reducing noise by up to 95%. Great in the executive suite or home office.

TURBO-COOL 300 \$189

High Performance Upgrade your AT/386 with our powerful Turbo-Cool 300. This popular OEM unit features built-in line conditioning, UL/CSA/TUV approval, 2-year warranty, and a high-capacity, *thermostatically-controlled* fan that automatically keeps your system up to 35° cooler. Great value!

TURBO-COOL 450 \$349

Maximum Performance The choice of PC professionals, our Turbo-Cool 450 features built-in line conditioning, autoselect input, independent regulation, external DC voltage adjustment, triple-stage output filter, 50cfm cooling fan, UL/CSA/TUV approval, 100,000 Hr. MTBF and 2-year warranty! Ideal for high-end workstations and network file servers.



COMPAQ

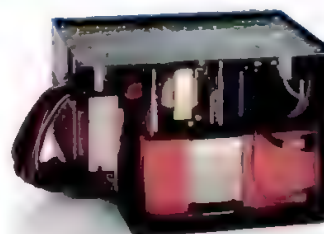
CP160 \$129

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— PC Magazine, Nov. 27, 1990

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-- PC Magazine



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-- CADalyst



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Get excited about doing what you've always wanted to do with Windows on the 9080i's larger 16-inch screen area. Highly compatible, in compliance with the Video Electronics Standards Association. Convergence & pin-cushioning controls. Dual inputs for two computers or two boards. The little differences that make for an exciting new monitor.



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Use the table below to compare service and support vendors reviewed in the 1992 PC Magazine Service and

THE FREE ON-SITE SERVICE ADVANTAGE

The cost of supporting and servicing the average corporate PC can run as much as the original cost of the PC each year. At the same time, many PC vendors are now putting greater emphasis on technical support and on-site service. This foldout table provides information about the service, support, and warranty policies of the 35 PC vendors we review in this issue.

With some notable exceptions, vendors offering free on-site service ranked higher on our survey in terms of the future likelihood of users purchasing from the same vendor. Reliability champions such as CompuAdd, Dell, Gateway 2000, Swan, and others offer free on-site service during the first year; yearly extensions cost 5 to 35 percent of the PC's original price.

Vendors that charged for on-site service during the first year often scored poorly on the likelihood of users buying from the same vendor again. But there were a few exceptions. Zeos, for example, charges for on-site service but still received above-average buy-again scores on both laptops and desktops. And

since maintenance costs skyrocket when applied to a number of PCs, many vendors negotiate prices for volume buyers or offer more extensive services. Hyundai charges for on-site service calls, but it has set a first for the industry in another area: free lifetime service under its standard warranty. After this limited-time offer expires, users will be able to purchase a contract for lifetime service.

Likewise, some companies offer higher levels of on-site service than others. Digital Equipment Corp., for example, will work on any PC in a network it has contracted to service—a real money-saver for a multivendor network. And CompuAdd says it will negotiate with a customer to fulfill any special needs, such as installing network software.

Although some vendors handle their own on-site service, most contract with a third-party provider. Service providers mentioned in our survey include BancTec, General Electric, Intelogic Trace, Intel Service, ISC-Bunker Ramo, Memorex Telex, NCR, and TRW. But even with a warranty that offers free on-site service, the service may not be automatic. Some vendors require you to call them first to

Companies listed in alphabetical order

☒—Yes ☐—No

	Acer America Corp.	Advanced Logic Research Inc.	AST Research Inc.	AT&T Computer Systems	Austin Computer Systems Inc.	Bon Indu
Distribution channel	Dealers	Dealers	Dealers	Dealers	Direct	Dea
MANUFACTURER'S WARRANTY						
Standard warranty	1 year	1 year	1 year	1 year	1 year	1 ye
Money-back guarantee	None	None	None	None	30 days	30 d
ON-SITE SERVICE						
On-site service available	☒	☒	☐	☒	☒	☐
Service provider	Intelogic Trace, ISC-Bunker Ramo	Intel Service	N/A	NCR	GE	N/A
Headquarters location (for each service provider)	San Antonio, TX; Tacoma, WA	Phoenix, AZ	N/A	Dayton, OH	Norcross, GA	N/A
Initial term	1 year	1 year	N/A	1 year	1 year	N/A
Free service during initial term	☐	☐	N/A	☐	☒	N/A
TECHNICAL SUPPORT						
Toll-free technical support available	☐	☒	☒	☐	☒	☒
900 number	☐	☐	☐	☐	☐	☐
Technical support hours (E.S.T.)	10:00 A.M.—10:00 P.M. M–F	9:00–8:00 M–F, 10:00–4:00 Sat.	8:00 A.M.—10:00 P.M. M–F, 10:00–4:00 Sat.	None	24 hours, 7 days a week	11:00
On-line bulletin board service	☒	☒	☒	☐	☒	☒
REPAIR SERVICE						
Manufacturer makes repairs	☒	☒	☒	☒	☒	☒
Manufacturer pays shipping charges to/from plant	☐ / ☒	☐ / ☒	☒ / ☒	☐ / ☐	☐ / ☒	☐ / ☒
Overnight shipping option	☒	☒	☒	☐	☒	☒
Manufacturer authorizes dealer repairs	☒	☒	☒	☒	☐	☐

N/A—Not applicable: The company does not provide this type of service

IBM Corp.	Leading Edge Products Inc.	Memorex Telex Corp.	NCR Corp.	NEC Technologies Inc.	Northgate Computer Systems Inc.	Packard Bell Electronics Inc.
Dealers	Dealers	Direct	Dealers	Dealers	Direct	Dealers
1 year None	20 months None	1 year None	1 year None	1 year None	1 year 30 days	1 year None
☐ N/A	☒ GE	☒ Memorex Telex	☒ NCR	☒ GE, NEC	☒ NCR	☒ Packard Bell
N/A	Atlanta, GA	Dallas, TX	Dayton, OH	Atlanta, GA; Boxborough, MA	Dayton, OH	Chatsworth, CA
N/A N/A	6 months ☒	1 year ☒	1 year ☐	1 year ☐	1 year ☒	1 year ☒
☒ ☐ 9:00-6:00 M-F	☐ ☒ 8:00 A.M.- 8:00 P.M. M-F	☒ ☐ 8:00 A.M.- 8:00 P.M. M-F	☐ ☐ None	☒ ☐ 8:30-7:00 M-F	☒ ☐ 24 hours, 7 days a week	☒ ☐ 8:00 A.M.- 12:00 A.M. M-F; 11:00-8:00 Sat., Sun.
☒	☒	☐	☐	☒	☒	☒
☐ N/A	☐ N/A	☒ ☒	☒ ☐ ☐	☐ N/A	☒ ☐ ☒	☒ ☒ ☒
N/A ☒	N/A ☒	☐ ☐	☐ ☒	N/A ☒	☒ ☐	☒ ☒

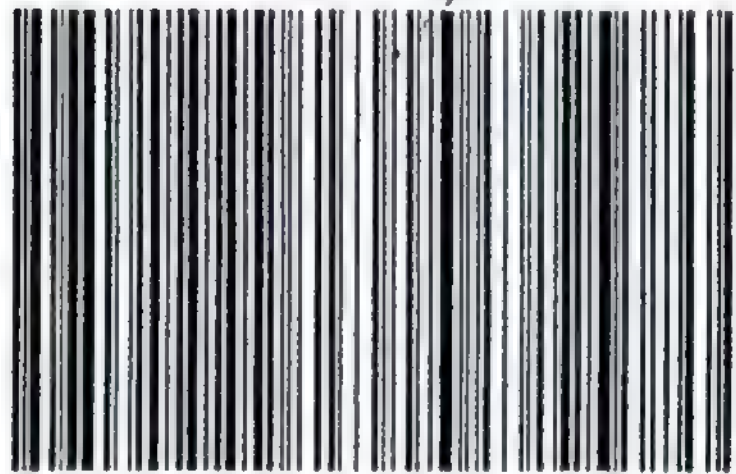
Texas Instruments Inc.	Toshiba America Information Systems Inc.	Unisys Corp.	Wang Laboratories Inc.	Wyse Technology Inc.	Zenith Data Systems	Zeos International Ltd.
Dealers	Dealers	Dealers, direct	Direct	Dealers	Dealers	Direct
1 year 10 days	1 year None	1 year 30 days	1 year None	1 year None	1 year None	1 year 30 days
☒ Texas Instruments	☐ N/A	☒ Unisys	☒ Wang	☒ Intellogic Trace	☒ Bull HN	☒ TRW
Austin, TX	N/A	Blue Bell, PA	Lowell, MA	San Antonio, TX	Billerica, MA	Fairfield, NJ
1 year ☐	N/A N/A	1 year ☐	1 year ☐	1 year ☐	1 year ☐	1 year ☐
☐ ☐ 9:00-6:00 M-F	☒ ☐ 10:00-8:00 M-F	☒ ☐ 8:00-5:00 M-F	☒ ☐ 7:00 A.M.- 2:00 A.M. M-F	☒ ☐ 10:00-8:00 M-F	☐ ☐ None	☒ ☐ 24 hours, 7 days a week
☐	☒	☒	☐	☒	☐	☒
☒ ☐ ☒	☒ ☐ ☒	☒ ☐ ☒	☒ ☐ ☒	☒ ☐ ☒	☐ N/A	☒ ☐ ☒
☒ ☐	☐ ☐	☒ ☒	☒ ☒	☒ ☒	N/A ☒	☒ ☐

ENDS

1. Follow instructions on the other side

Back

GBSSlipBack-001B

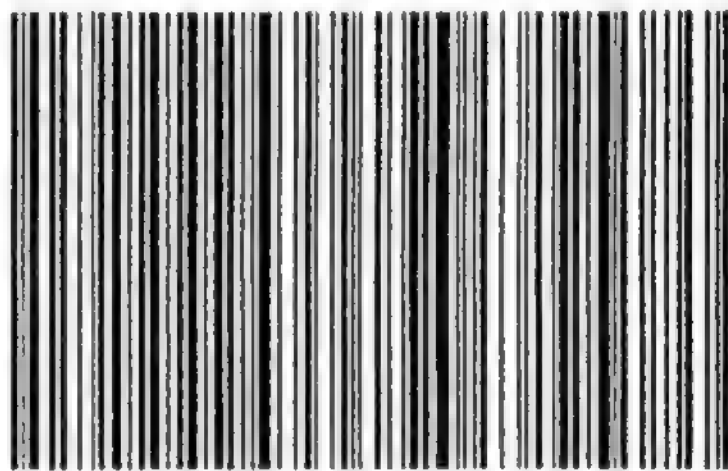


Inverted Back

1. Follow instructions on the other side

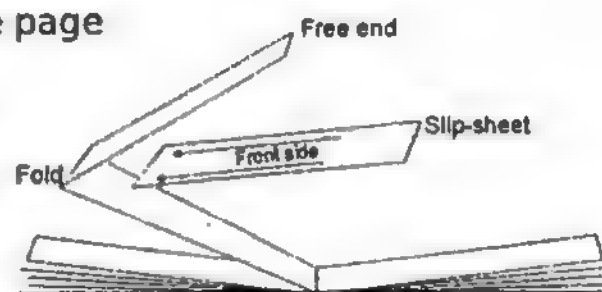
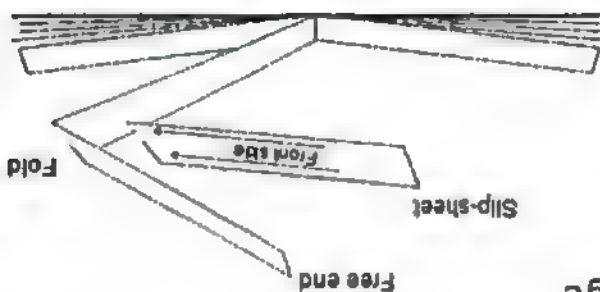
Foldout slip-sheet

GbsSlipSheet-001



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
3. Front side touching the free page
4. Arrow pointing to the fold
5. Slice the folded edge
6. Close the page and slip-sheet



Companies listed in alphabetical order

☒—Yes ☐—No

	Epson America Inc.	Everex Systems Inc.	Gateway 2000	Hewlett-Packard Co.	Hyundai Electronics America
Distribution channel	Dealers	Dealers	Direct	Dealers	Dealers
MANUFACTURER'S WARRANTY					
Standard warranty	1 year	1 year	1 year	1 year	18 months
Money-back guarantee	None	None	30 days	None	None
ON-SITE SERVICE					
On-site service available	☐	☒	☒	☒	☒
Service provider	N/A	National Computer Service	TRW	Hewlett-Packard	TRW
Headquarters location (for each service provider)	N/A	Minneapolis, MN	Grand Prairie, TX	Mountain View, CA	Grand Prairie, TX
Initial term	N/A	3 months or 1 year	1 year	Unlimited	1 year
Free service during initial term	N/A	☒	☒	☒	☐
TECHNICAL SUPPORT					
Toll-free technical support available	☒	☐	☒	☒	☒
900 number	☐	☐	☐	☐	☐
Technical support hours (E.S.T.)	9:00–8:00 M–F	8:00 A.M.–8:00 P.M. M–F	7:00 A.M.–1:00 A.M. M–F	7:00 A.M.–8:00 P.M. M–F	11:00–8:00 P.M. M–F
On-line bulletin board service	☒	☒	☒	☐	☐
REPAIR SERVICE					
Manufacturer makes repairs	☐	☒	☒	☒	☐
Manufacturer pays shipping charges to/from plant	N/A	☐	☐	☐	N/A
Overnight shipping option	N/A	☒	☒	☒	N/A
Manufacturer authorizes dealer repairs	☒	☒	☐	☒	☒

N/A—Not applicable: The company does not provide this type of service.

	PC Brand Inc.	Sharp Electronics Corp.	Swan Technologies Inc.	Tandon Corp.	Tandy GRiD Systems
Distribution channel	Direct	Dealers	Direct	Direct	Dealers
MANUFACTURER'S WARRANTY					
Standard warranty	1 year	1 year	2 years	1 year	1 year
Money-back guarantee	30 days	None	30 days	30 days	30 days
ON-SITE SERVICE					
On-site service available	☒	☐	☒	☒	☒
Service provider	TRW	N/A	TRW	TRW	Radio Shack
Headquarters location (for each service provider)	Moorpark, CA	N/A	Fairfield, NJ	Moorpark, CA	Fort Worth, TX
Initial term	1 year	N/A	2 years	1 year	1 year
Free service during initial term	☒	N/A	☒	☒	☐
TECHNICAL SUPPORT					
Toll-free technical support available	☒	☒	☒	☒	☐
900 number	☐	☐	☐	☐	☐
Technical support hours (E.S.T.)	8:00 A.M.–9:00 P.M. M–F, 10:00–6:00 Sat.	9:00–8:00 M–F	9:00 A.M.–9:00 P.M. M–F, 9:00–5:00 Sat., 9:00–5:00 Sun.	24 hours, 7 days a week	9:30–6:00 P.M. M–F
On-line bulletin board service	☒	☐	☒	☒	☒
REPAIR SERVICE					
Manufacturer makes repairs	☒	☒	☒	☒	☒
Manufacturer pays shipping charges to/from plant	☐	☐	☐	☐	☐
Overnight shipping option	☒	☒	☒	☒	☐
Manufacturer authorizes dealer repairs	☐	☒	☐	☒	☒

N/A—Not applicable: The company does not provide this type of service.

es of the 35 ility Survey.

ate the problem; only then do they authorize the party provider to dispatch a repair technician. Companies that offer their own on-site service include Digital, Hewlett-Packard, Memorex Telex, NEC, Packard Bell, Tandy/GRiD, Texas Instruments, Unisys, Wang, and Zenith Data Systems. Memorex Telex, both a vendor and a service provider, offers free on-site service for its own products and will even train equipment maintenance people at the customer site. Hewlett-Packard puts its own diagnostic software on its U series of Vectras; the remarkable easy-to-use program helps a user determine the problem is, with or without simultaneous help from HP's telephone support crew. Often the problem turns out to be a configuration conflict that is resolved without on-site intervention. Another trend is showing up among vendors. Customers do not need on-site service, but vendors have had to develop ways to handle problems that arise away from the office. Many companies offer on-site service, with various repair and response times. Companies, such as AST, Dell, and GRiD, offer a loaner machine while a machine is being repaired.—Tom Unger

SURVEY METHODOLOGY

The 1992 Service and Reliability Survey was conducted over a two-month period (November 21, 1991, to January 15, 1992) by Willard & Shullman, a market research firm based in New York City. Out of the 17,000 *PC Magazine* subscribers surveyed, 8,592 responded—a response rate of 51 percent.

On November 21, 1991, Willard & Shullman sent a four-page questionnaire, accompanied by a cover letter, a self-addressed stamped envelope, and a dollar bill, to a random sample of 17,000 *PC Magazine* subscribers living in the contiguous United States.

Nonrespondents received a follow-up mailing, containing a second copy of the questionnaire, on December 10, 1991. A final reminder postcard was mailed on January 10, 1992, to those people who did not respond to the second mailing.

Willard & Shullman mailed all survey materials and received, edited, coded, and tabulated the survey returns. These procedures were carried out in accordance with established marketing research standards.

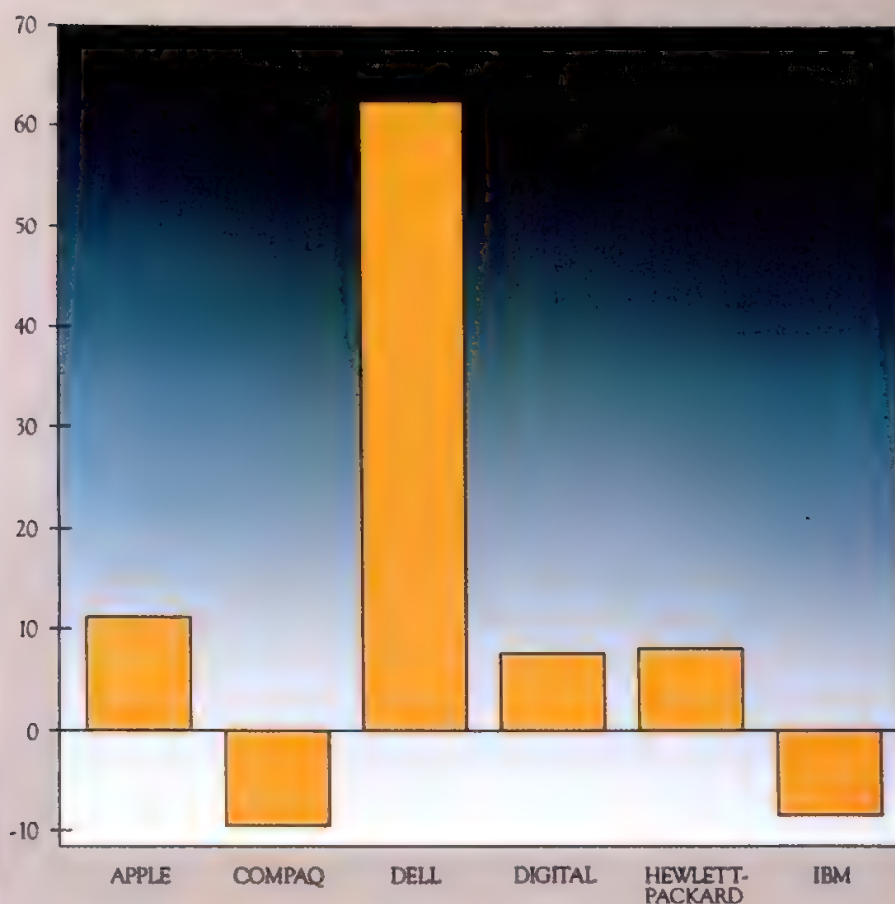
Compaq Computer Corp.	CompuAdd Computer Corp.	Dell Computer Corp.	Digital Equipment Corp.	DTK Computer Inc.
Dealers	Direct	Dealers, direct	Dealers, direct	Dealers
1 year None	1 year 30 days	1 year 30 days	1 year 30 days	1 year None
☒ GE, Intellogic Trace, TRW Atlanta, GA; San Antonio, TX; Fairfield, NJ 1 year ☐	☒ Memorex Telex Austin, TX 1 year ☒	☒ BancTec Dallas, TX 1 year ☒	☒ DEC Merrimack, NH 1 year ☒	☒ GE Atlanta, GA 1 year ☒
☐ 8:00 A.M.— 8:00 P.M. M-F ☐	☐ 9:00—8:00 M-F ☐	☐ 7:00 A.M.— 10:00 P.M. M-F, 9:00—5:00 Sat., 11:00—4:00 Sun. ☐	☐ 8:30—8:00 M-F ☐	☐ 10:00—8:00 M-F ☐
☐ N/A ☒	☒ ☐ / ☒	☒ ☐ / ☒	☒ ☒ / ☒	☒ ☐ / ☒
☒ N/A ☒	☒ ☐	☒ ☐	☒ ☒	☒ ☒

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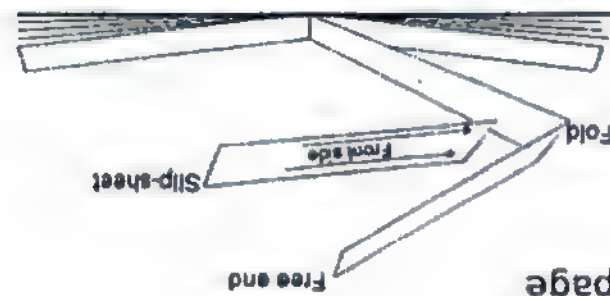
CIRCLE 029 ON READER SERVICE CARD

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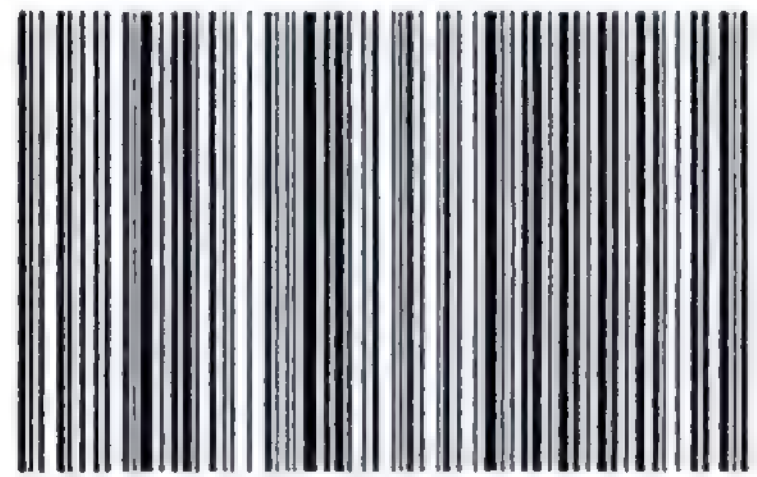
1. Front side touching the free page
2. Arrow pointing to the fold

Slice the folded edge

Close the page and slip-sheet



Inverted Foldout slip-sheet

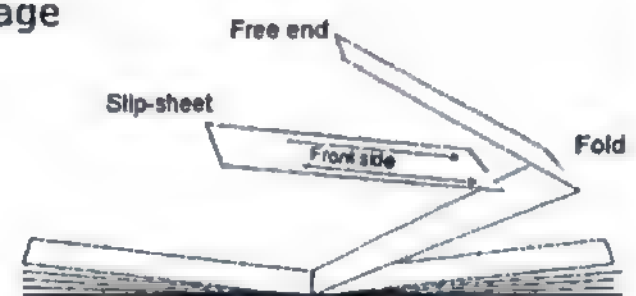


GbsSlipSheet-001



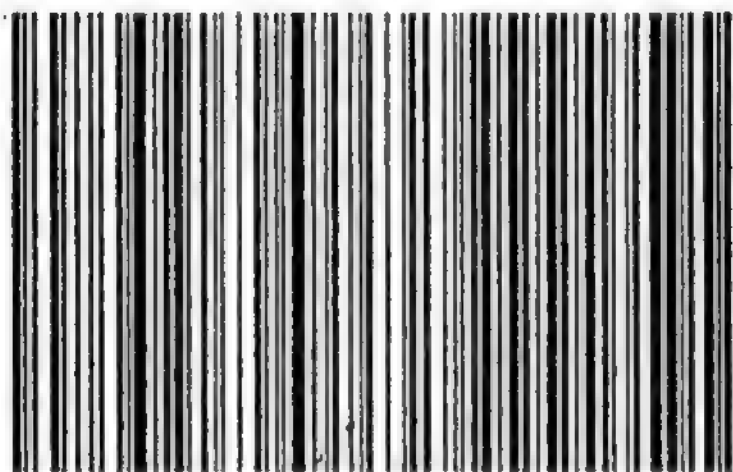
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side

NOW WE'RE JUST LOOKING

This year, Dell Computer Corporation broke into the FORTUNE 500® for the first time ever.

Amazingly, it took us less than eight years to build an \$890 million international business. Which, in all likelihood, includes taking many customers from the better-known companies mentioned in this ad.

This makes Dell, currently, one of the fastest growing computer companies in the FORTUNE 500. And then some.

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So, it's simple. We've made a lot of computers. And those computers, well, they've made a lot of noise in the customer satisfaction polls. In fact, we beat IBM and Compaq in every *PC Week* Customer Satisfaction poll we've ever competed in. We also managed to win 53 product awards in 1991 alone.

Why?

Maybe it's because of our toll-free technical support. Maybe it's because we usually cost 10-20% less than our larger competitors. Maybe it's because that price includes service which can get a trained technician to your home or office usually the next business day.[^] Or maybe, just maybe, we make a better computer.

That could be why over two-thirds of the companies in the FORTUNE 500 now buy from Dell. So, you see, we were part of the FORTUNE 500 even before we were part of the FORTUNE 500. We'd like to be part of your company too.

Why not give us a call?

WE COULD CHALLENGE THE COMPETITION TO MATCH OUR NEW 4-HOUR ON-SITE SERVICE, BUT THEY WOULDN'T SHOW UP UNTIL TOMORROW.

Call for emergency computer service from your retailer and what do you get? Often, an agonizing wait, watching your business slowly grind to a halt.

Which is why Dell is introducing Critical Care™ service in 17 major metropolitan areas. Beginning May 29, if you have a mission-critical problem, you'll be able to get a technician on-site in no more than four hours.△

And not just some guy with a set

of screwdrivers. We're talking about a full-fledged technician trained on Netware and on every Dell system.

When he arrives, he will have been briefed on your problem. Given a history of your system. And equipped from a multi-million dollar parts inventory.

In short, a computer commando.

But the best part about Critical Care is that you'll probably never have to use it.

Our award-winning technical hotlines solve 90% of problems reported over the phone, usually in 10 minutes or less.

So call us and ask for more details about Critical Care. Or call your retailer and ask about their emergency service. They'll get back to you.

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CIRCLE 043 ON READER SERVICE CARD



SERVICE AND RELIABILITY

individual components, respondents gave the keyboard marks that translated into a score of 9.15, significantly higher than the 8.87 average. Scores for the other components—motherboards, hard disks, monitors, video boards, floppy disk drives, keyboards, internal modems, and power supplies—placed within the average range.

We received enough responses to evaluate the 286-based and 386-based machines in PC Brand's product line. Within these processor classes, scores for the four key categories in terms of the whole PC and the reliability of individual components were average.

PC Brand offers a standard warranty covering one year on parts and labor. During the first year, on-site service from TRW is free. Users desiring a longer on-site plan may purchase a contract at \$200 per year up to 5 years. PC Brand maintains technical support on a toll-free line weekdays from 7:00 A.M. to 8:00 P.M. C.S.T. and Saturdays from 9:00 to 5:00; questions are routed to in-house specialists. The company also tailors special support options for volume buyers.

FACT FILE

PC Brand Inc., 405 Science Dr., Moorpark, CA 93021; technical support, 800-347-8324; sales, 800-722-7263; fax, 800-722-7392.

CIRCLE 510 ON READER SERVICE CARD

SHARP ELECTRONICS CORP.

by Gayle C. Ehrenman

Sharp Electronics Corp. earned both a *PC Magazine* Editors' Choice award and our Technical Excellence Award in 1991 for the Sharp PC-6220, a 4.5-pound 286 notebook it developed in conjunction with Texas Instruments. But the company stumbled on service and support.

As a group, Sharp's laptops posted an 8.26 in overall reliability on our survey, well within range of the 8.59 average (out of a possible 10). Texas Instruments, by contrast, finished with a score of 8.63—not significantly different from Sharp's score. By comparison, Zeos International, the leader in this category, posted an outstanding 9.18.

Sharp fared better on satisfaction with

repair service, where once again its 7.15 score was not significantly below the 7.59 average. Satisfaction with technical support, however, proved Sharp's undoing. Sharp Electronics came in among the lowest in this category, with a 6.53 rating that was significantly below the 7.52 average and a far cry from Dell's category-leading 9.12.

Despite its poor showing on technical support, Sharp turned in middle-of-the-pack numbers for future buying plans. The company's 6.63 rating placed it just behind Texas Instruments, but not significantly below the 6.87 average.

When Sharp laptops were evaluated for reliability of individual components, the only score significantly below the average was the 8.32 for floppy disk drives (versus the 8.94 average for all manufacturers). Although our survey did not indicate which of Sharp's models were covered, it is worth noting that the Sharp PC-6220, Sharp's most advanced notebook during 1990 and much of 1991, featured a 286 processor with a hard disk but no internal floppy disk drive.

Sharp is making an effort to improve repair policies and technical support. Currently, Sharp offers a standard one-year parts-and-labor warranty and a toll-free technical support number that it concedes can be hard to reach. Rather than an on-site service option, Sharp maintains a number of SABER (Sharp Authorized Business Equipment Repair) stations where you can take your laptop for repair.

Users may also send their laptops to one of Sharp's five factory service centers, which offer different levels of service on the basis of extended-service contracts called EXTRAs. These one-year contracts range in price from \$130 to \$160, depending on the options you want. The lowest level gives you regular repair service with ground shipment; the highest level, priority repair with next-day air shipment, ensures that you get your machine back within three days of its receipt by Sharp.

Sharp plans to upgrade its technical support line to make it more responsive

and add an on-line bulletin board system. The company is also exploring ways to let customers communicate with it directly via computer. Sharp hopes to be able to implement some of these changes by the end of 1992.

FACT FILE

Sharp Electronics Corp., 1 Sharp Plaza, Mahwah, NJ 07430; technical support, 800-732-8221; sales, 201-529-9600; fax, 612-633-1325.

CIRCLE 511 ON READER SERVICE CARD

SWAN TECHNOLOGIES INC.

by Joseph Desposito

By all indications, Swan Technologies is doing a bang-up job of keeping customers happy. Swan rated significantly above the average in three out of four key areas on our survey. Swan placed among the highest-ranking desktop PC companies on overall PC reliability; its 8.95 score put it in the company of Gateway and Zeos (the average score was 8.51 out of a possible 10). Swan was also

among the highest (along with Northgate) on satisfaction with technical support, with a score of 8.69. Future likelihood of buying from the vendor was also significantly higher than average: Swan scored an impressive 7.98 against an

Swan placed among the highest-ranking desktop PC companies on reliability.

average of 6.42 in that category. Satisfaction with repair service earned Swan a score of 8.38, not high enough to be considered significantly better than the 7.93 average score.

When readers rated the reliability of individual components across Swan's entire line, the company again achieved some top-notch ratings. Its motherboards garnered a score of 9.42, among the highest of all 35 manufacturers considered here. The 9.32 rating on floppy disk drives tied with Zeos International in the highest score for that category. Users rated Swan's internal modem at 9.83, again one of the highest scores in that category. Swan's other scores on component reliability fell

within the average range.

One reason for Swan's fine showing may be that its two-year warranty is double that of many of its competitors. At the end of this period, Swan lets you extend the warranty for an additional year for \$189. Like many other companies that sell through direct mail, Swan offers a 30-day money-back guarantee.

Swan backs its warranty with two years of on-site service, provided by TRW; this is included in the system price. But if you choose, you may send equipment to Swan for repair. You pay the shipping costs to Swan; Swan pays the cost of shipping the unit back to you via the same type of carrier you used.

Swan also maintains a bulletin board service. Unlimited free technical support is available on a toll-free number for 12 hours a day on weekdays and 8 hours a day on Saturdays, Sundays, and holidays.

Customers who are technically inclined can call Swan's voice-automated Fax-FACTS service and request data sheets for third-party products sold by Swan. Swan then faxes the data sheets to you.

Policies such as the two-year warranty and two years of free on-site service indicate that Swan Technologies is committed to customer satisfaction. It's not surprising that users have ranked Swan significantly higher than the norm in several areas of our survey.

FACT FILE

Swan Technologies Inc., 3075 Research Dr., State College, PA 16801; technical support, 800-468-7926; sales, 800-468-9044; fax, 814-237-4450.

CIRCLE 512 ON READER SERVICE CARD

TANDON CORP.

by Greg Pastrick

Once a pioneer in manufacturing hard disks for personal computers, Tandon Corp. is struggling to satisfy customers with its line of PCs. Tandon's scores fell mostly below average among manufacturers on our survey in all four key categories—overall PC reliability, future likelihood of buying from the vendor, satisfaction with repair service, and satisfaction with technical support.

Tandon's score of 7.58 on overall PC

reliability was significantly lower than the 8.51 average for desktops as a whole (out of a possible 10), as was its 7.14 score on satisfaction with repair service versus the 7.93 average. Although satisfaction with technical support, at 7.26, was average, it was not enough to sway users: Tandon earned a worrisome 4.97 when we asked users if they would buy again—well below the norm of 6.42 for that category.

When our readers considered the reliability of individual components as subgroups of the manufacturer, Tandon came out significantly below the average on the motherboard (8.24 versus the 8.89 average), hard disk (7.57 versus the 8.51 average), and the video graphics board (8.34 versus the 8.93 average); its scores on the floppy disk drive, monitor, keyboard, internal modem, and power supply were within the average range. We did not receive enough responses for any model to be able to evaluate Tandon on the basis of specific processor class.

Recently, Tandon has been making an effort to improve customer relations and boost satisfaction with service and support. In the first quarter of 1992, it expanded its toll-free technical support to operate around the clock, seven days a week. Tandon also maintains a fax line and an on-line BBS.

Tandon's standard and extended warranties and its on-site service programs are typical for a direct marketer. Tandon offers a standard one-year warranty but adds a 30-day money-back guarantee. On-site service, which it delegates to TRW, is free the first year. Alternatively, Tandon authorizes dealers to make repairs or performs them itself, paying shipping charges both ways.

FACT FILE

Tandon Corp., 405 Science Dr., Moorpark, CA 93021; technical support, 800-487-8234; sales, 800-800-8850; fax, 805-529-8408.

CIRCLE 513 ON READER SERVICE CARD

TANDY CORP./GRID SYSTEMS CORP.

by Greg Pastrick

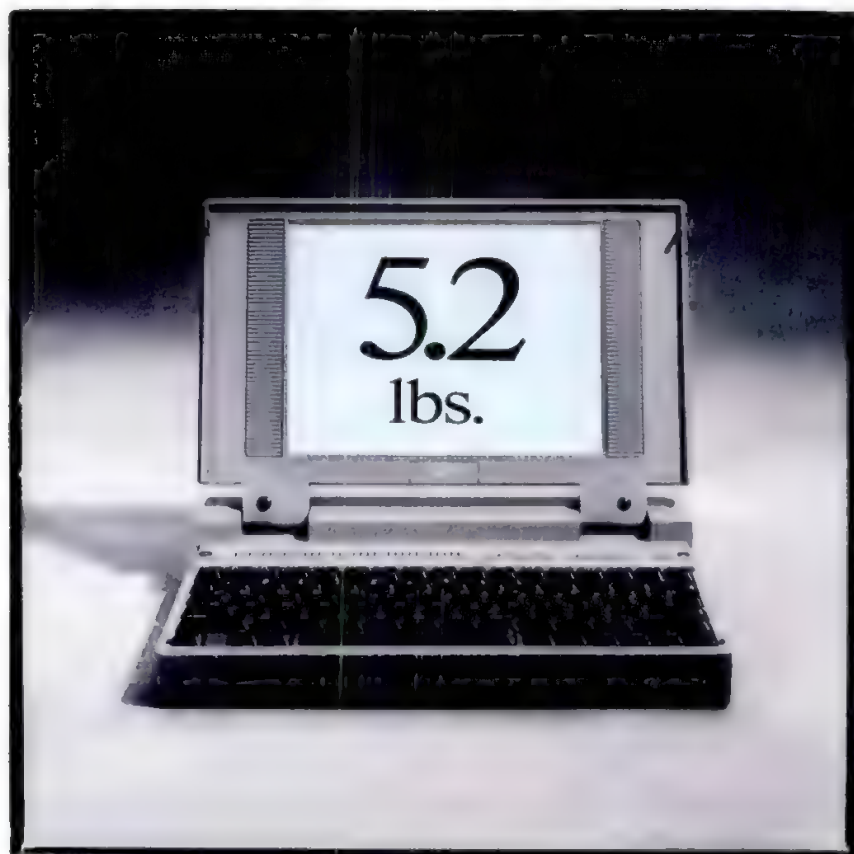
To the naked eye, Tandy Corp.'s and GRiD Systems Corp.'s product lines could not be more different despite their corporate kinship as divisions of the Radio Shack family. Tandy sells its computers at thousands of Radio Shack home-hobbyist shops, which will also sell you everything from phone jacks to radio-controlled cars. GRiD is known as a maker of high-performance, sleek portables. Such stereotyping disregards GRiD's desktop line and Tandy/GRiD's pioneering developments in truly portable computing. Tandy/GRiD currently manufactures laptops for Digital Equipment Corp. and other labels as well as for GRiD.

Our survey evaluated 8086/8088-based laptops and 8086-, 8088-, 286-, and 386-based desktops. But we did not attempt to determine whether the respondents were referring to GRiD's units or Tandy's. Laptop ratings were calculated for Tandy/GRiD as a whole and were based primarily on our respondents' experience with the 8086/8088 processor class. Under these circumstances, Tandy/GRiD managed to score within the average range in three out of four categories: Overall PC reliability was 8.67 compared with the 8.59 average (out of a possible 10), satisfaction with repair service was 7.32 compared with the 7.59 average, and satisfaction with technical support was 7.33 compared with the 7.52 average. Given the general level of satisfaction that these average ratings imply, it is tempting to interpret the low 5.98 score for future buying plans (compared with the 6.87 average) as a vote against the older processor types.

We received enough survey responses to evaluate 8088/8086-, 286-, and 386-based desktops. On ratings by manufacturer, which were based on the entire product line, Tandy/GRiD scored close to the average on overall PC reliability (8.56 versus the 8.51 average). But the company came in significantly below the average on satisfaction with repair service

Tandy/GRiD scored close to the average when it came to overall PC reliability.

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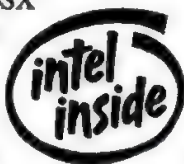
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TEXAS INSTRUMENTS INC.

by Ann Ovodow

(7.48 versus the 7.93 average), satisfaction with technical support (6.92 versus the 7.48 average), and future likelihood of buying from the vendor (5.17 versus the 6.42 average).

Tandy/GRiD's ratings show improvement as you move up processor classes toward the 386s. They fall into the average range or better at the 386 level on the four manufacturer categories and on the reliability of individual components. In the internal modem category, Tandy/GRiD's 9.92 score was the highest among all of the 35 manufacturers and was significantly higher than the second-highest score (Gateway's rating of 9.44).

Most of GRiD's sales are mail order, with secondary distribution in superstores and in its own 50 sales and training centers across the United States.

While around 30 percent of GRiD's sales are to government agencies, the bulk goes to large-contract multiuser corporate accounts. Consequently, GRiD's warranties are tailored for original equipment manufacturers, VARs (value-added resellers), and resellers. Customized service programs allow preferred on-site service and repair. Laptops are eligible for swapper and loaner programs as well.

In contrast, Tandy is oriented toward single-user service and support through its dealer distribution channel and its chain of Radio Shack Repair Centers. Warranty, service, and support programs are standard, and its Hotline BBS, carried on CompuServe, America Online, and PC Link, helps with troubleshooting. Although extended warranty costs depend on the components in any given machine, Tandy's service and support options have a generic quality rather like the standard fare from Radio Shack: You may not be able to get everything there, but chances are you will walk away with what you need.

FACT FILE

Tandy Corp./GRiD Systems Corp., 1800 One Tandy Center, Fort Worth, TX 76102; technical support, 817-390-3861; sales, 817-390-3011.

CIRCLE 514 ON READER SERVICE CARD

*On overall
PC reliability, TI stood
solidly in the middle
of the pack.*

Texas Instruments sells desktop PCs, but ever since it collaborated with Sharp Electronics Corp. to bring one of the earliest notebooks to market, the notebooks have attracted more attention. The TI TravelMate (dubbed the Sharp PC-6220 by Sharp), earned both companies *PC Magazine's* Award for Technical Excellence in 1991. In the meantime, TI has continued to develop the TravelMate series, the most recent release being its Windows-capable TravelMate 3000 WinSX.

In our survey, TI's notebooks earned average scores in the four key categories. The score for satisfaction with technical support came to 6.72 against the 7.52 average (out of a possible 10). TI earned a 6.93 on satisfaction with repair service, still within range of the 7.59 average.

On overall PC reliability, TI stood solidly in the middle of the pack, registering an average score, 8.63. Users also rated the likelihood that they would buy from TI in the future as 6.75—another average score.

TI's desktops earned similar scores: Overall PC reliability, satisfaction with repair service, and satisfaction with technical support were in the average range. But plans to buy from TI in the future dropped significantly below the 6.42 average to 5.29. For both desktops and notebooks, reliability ratings on individual components did not depart significantly from the average. Neither TI's desktops nor its notebooks generated enough responses to enable us to evaluate subgroups within these categories.

Texas Instruments offers a limited warranty that covers parts and labor for a year but does not include on-site service. Under this warranty, users are encouraged to take or ship their units to an Authorized TI Service Center for repairs, though they can send the machines to the appropriate division of TI instead. Texas Instruments maintains about 40 Autho-

rized Service Centers nationwide.

At the time of purchase or at any time during the first year of ownership, users may convert their limited warranty to one that includes on-site service. The cost of conversion depends on the product: During the first year, the cost is \$192 for a TravelMate 3000 or \$199 for a TravelMate 3000 WinSX. Extending this policy for another year costs \$372 for either machine. TI's nationwide network of 120 field offices handles on-site service.

Texas Instruments does not maintain a toll-free line for technical support. Instead, users who call in are asked to describe the problem briefly and leave a number where they can be called back. According to Texas Instruments, its quick call-backs save users considerable time on the phone.

FACT FILE

Texas Instruments Inc., P.O. Box 202230, Austin, TX 78720-2230; technical support, 512 250-7407; sales, 800-527-3500.

CIRCLE 515 ON READER SERVICE CARD

TOSHIBA AMERICA
INFORMATION SYSTEMS INC.

by Tom Unger

It should surprise no one that Toshiba America Information Systems, which helped define the laptop and notebook market, earned solid user satisfaction scores in this category. But while the smaller systems have defined this Japanese manufacturer's American image, its desktop machines also turned in respectable results. Toshiba's repair and support scores came in average, but in overall PC reliability and future likelihood of buying, they were significantly higher than average. Toshiba sells its desktop and notebook PCs exclusively through dealers and distributors, and it remains on the cutting edge of laptop technology: It was the first to ship to market a battery-powered 486 laptop, the Toshiba 4400SX.

In the four key categories for laptop manufacturers, Toshiba's excellent score of 8.81 (out of a possible 10) on overall PC reliability ranked among the highest, with Zeos, AST, Compaq, NEC, and Sharp. The high rating of 7.65 on future likeli-



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CIRCLE 389 ON READER SERVICE CARD

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hood to buy from Toshiba indicates that users have had positive experiences with their machines.

For technical support and repairs, however, both the laptop and desktop lines only garnered scores in the average range. One possible reason could be Toshiba's lack of on-site repair. Instead, the company offers its Exceptional Care Service program, which provides 48-hour turnaround from a manufacturer's repair depot. Since Toshiba does not authorize dealer repairs, customers must do without their machines for at least two days, not including shipping time.

Toshiba claims, however, that because it does all of its own repairs, it has far better quality control. Indeed, for the recently introduced class of 386SX notebooks, Toshiba was among the highest rated of all the manufacturers in our survey for overall PC reliability.

The company offers a full one-year warranty under its Exceptional Care Service program. Customers can extend their warranties for up to two years for an additional cost that ranges from \$199 to \$1,399 for two years, depending on the model.

FACT FILE

Toshiba America Information Systems Inc., 9740 Irvine Blvd., Irvine, CA 92718; technical support, 800-999-4273; sales, 714-583-3000.

CIRCLE 516 ON READER SERVICE CARD

UNISYS CORP.

by Tom Unger

Unisys Corp. is a worldwide corporation known for large networked mainframes, minicomputer systems, and desktop workstations. The company, which has been struggling to reverse its losses in the last few years, sells a full line of desktop computers through the direct channel and value-added resellers (VARs).

Our survey data gives Unisys average ratings in overall PC reliability (8.55 versus the 8.51 average out of a possible 10), comparable to ratings received by Acer, Epson, Everex, and Packard Bell. Scores for satisfaction with repair service (8.10 versus the 7.93 average) and technical support (7.35 versus the 7.48 average) also fall in the average range. Despite

these indications of overall satisfaction, Unisys scored a 4.92 on future likelihood of buying from the vendor, significantly lower than the 6.42 average; this is possibly due to high prices and uncertainty about the future of Unisys.

Unisys offers a standard one-year parts-and-labor warranty for all of its desktop systems. The company makes all repairs at its own depots around the country and also authorizes dealer repairs. Unisys offers 48-hour turnaround for customers who do not want to pay the additional cost for same- or next-day on-site service. On-site service costs from \$4 to \$12 per month, depending on system configuration.

Until recently, Unisys offered technical support via a 900 number to customers who had not purchased a maintenance contract with their machines. Now the company has abandoned this policy, which no doubt accounted for much of the dissatisfaction with its technical support. Technical support is available on regular and toll-free lines, weekdays from 8:00 to 5:00 E.S.T.; Unisys also maintains a bulletin board.

If Unisys can keep from drowning in red ink, the quality of service could catch up with the company's solid scores in reliability and technical support.

FACT FILE

Unisys Corp., Township Line and Union Meeting Rds., Blue Bell, PA 19424; technical support, 800-448-1424; sales, 800-448-1424; fax, 716-272-6790.

CIRCLE 517 ON READER SERVICE CARD

WANG LABORATORIES INC.

by Tom Unger

Like Digital Equipment Corp. and Unisys Corp., Wang Laboratories was one of the original vendors of networked desktop machines and mini-

computers to the corporate market. And like the others, Wang has struggled to make the transition to the booming PC market. The company, which once dominated offices with its word processing systems, sells a full line of PCs directly to

large commercial and corporate customers and through large resellers. But unlike Digital and Unisys, which turned in decent or above-average scores in most of the four major categories, Wang was below average on three out of four.

Wang received a 7.91 rating on over-

all reliability from its users, significantly below the 8.51 average (out of a possible 10). Users of Wang PCs rated their future likelihood of buying from Wang at 4.39, significantly below the 6.42 average for all PC users in our survey and the lowest for any manufacturer.

This low score may reflect anxiety about Wang's future: The death of its founder and the expulsion of his son from the top job—as well as a string of losing years—have not earned Wang much investor or buyer confidence. Wang has traditionally extracted a high price for its machines and even the most buttoned-down corporate shop has learned to buy from high-volume suppliers who offer lower prices and competitive service options such as free on-site service.

Readers rated Wang's repair services on the low side of average, but not significantly so (7.37 versus the 7.93 average). But satisfaction with technical support, at 6.70, was well below the 7.48 average for all manufacturers.

Wang offers a standard one-year parts-and-labor warranty for all its desktop PCs. One-year extensions start at \$84 and depend on the individual system and its configuration. Wang does not offer a money-back guarantee.

Wang authorizes service through its large distributors for those who have not bought their system directly from the manufacturer. Except for those systems sold through dealers, most repairs are carried out by the Wang. The company mirror ships all items it receives for repair. On-site service starts at \$48 per year, depending on the model. Customers may

Wang, which once dominated office word processing, sells a full line of PCs directly to resellers.

reach toll-free technical support weekdays from 7:00 A.M. to 2:00 A.M. E.S.T. or through CompuServe.

FACT FILE

Wang Laboratories Inc., One Industrial Ave., Lowell, MA 01851; technical support, 800-247-9264; sales, 800-835-9264; fax, 508-656-8329.

CIRCLE 518 ON READER SERVICE CARD

WYSE TECHNOLOGY INC.

by Oliver Rist

There isn't much good news in our survey for Wyse Technology. Our respondents rated the company's desktop systems well below average on all four of our overall manufacturer categories: overall PC reliability, future likelihood of buying from the vendor, satisfaction with repair service, and satisfaction with technical support.

Wyse finished among the lowest of all manufacturers in all four categories. On overall PC reliability, Wyse scored a 7.99—significantly behind the 8.51 average (out of a possible 10). Wyse placed among the lowest on whether the users would consider buying from the company again with a score of 4.71, compared with the 6.42 average. Wyse also finished significantly below average on customer satisfaction with repair service (7.28) and technical support (6.64), where the averages were 7.93 and 7.48, respectively.

These results should cause some concern at Wyse. The company has significantly revised its support and service policies since 1990, says a company spokesperson. Wyse had traditionally sold its systems primarily through distributors and VARs (value-added resellers) and has not had much experience dealing directly with end users. The new policies were supposed to change that. On-site service, handled by Intelogic Trace, costs \$99 for the first year. Wyse also offers toll-free technical support from 10:00 to 8:00 E.S.T., a 24-hour BBS, and 24-hour fax-on-demand. This last feature, which can handle pictorial information as well as text, uses a touch-tone menu and faxes documents to you immediately.

The company does its own repairs through its authorized service centers, but this part of the program is under revision.

COVER STORY SERVICE AND RELIABILITY

Wyse pays for return shipping and also does overnight shipping for an additional fee. Wyse recently introduced a new on-site service plan for its laptop customers that offers a 48-hour pickup-to-return time. Additionally, it can deliver the repaired PC to a location other than the one from which it was picked up.

Wyse has also been monitoring its support service by sending questionnaire cards with a repaired unit; these ask customers to rate the service they have received as compared with similar experiences with other companies. So far, Wyse claims to be well ahead of the competition. Perhaps the company should get in touch with our respondents.

FACT FILE

Wyse Technology Inc., 3471 N. First St., San Jose, CA 95134; technical support, 800-800-9973; sales, 800-438-9973; fax, 408-922-4390.

CIRCLE 519 ON READER SERVICE CARD

ZENITH DATA SYSTEMS

by Joseph Desposito

Zenith Data Systems, acquired by Groupe Bull of France in the spring of 1990, has not made a big hit with its customers in the service and reliability arena, according to our survey. ZDS's desktop PCs scored significantly lower than the average in overall PC reliability (8.18 versus the 8.51 average out of a possible 10), satisfaction with repair service (7.49 versus the 7.93 average), and satisfaction with technical support (6.97 compared with the 7.48 average). The dissatisfaction with Zenith Data Systems' service and reliability held true even for laptops and notebooks—units that have won *PC Magazine* Editors' Choice awards.

Our survey results suggest that customers were dissatisfied with all the products in the line. The likelihood that they would buy ZDS desktops again (5.07 versus the 6.42 average) and laptops (5.40 versus the 6.87 average) were significantly lower than average.

ZDS gives a one-year warranty on products. After this period, you may extend the warranty at an additional cost that depends on the system you purchased. ZDS offers on-site service through its Total Care program. As with its extended warranty, the cost of this ser-

vice depends on the system you purchase. On-site service is provided by Bull HN Information Systems of Billerica, Massachusetts. For laptops and notebooks, ZDS offers the Laptop Mail-In Program, which promises to repair your unit and return it to you within 48 hours.

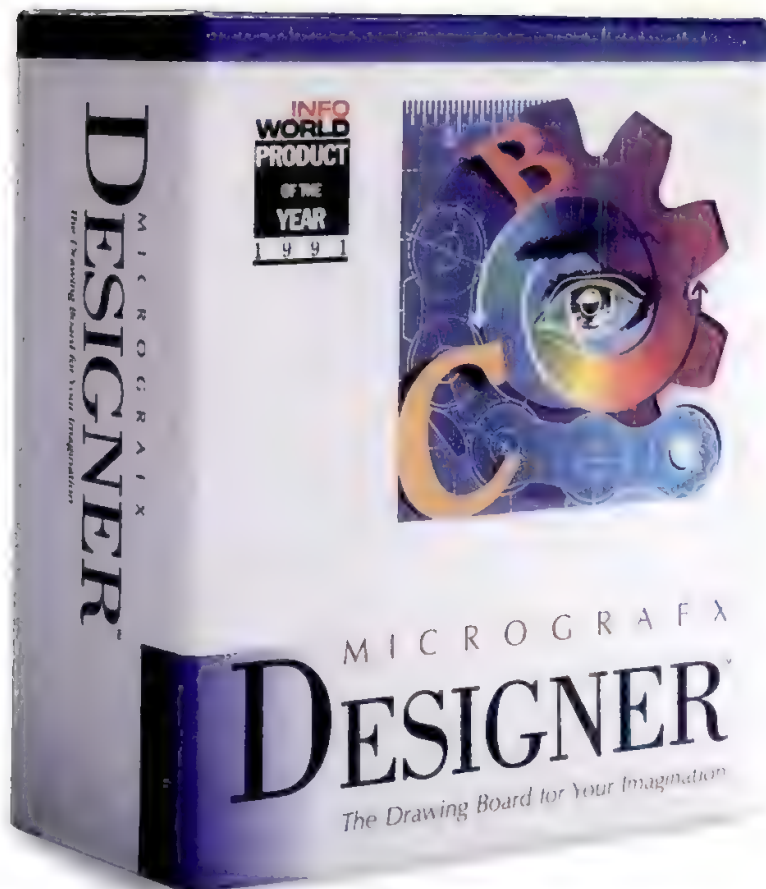
If you do not have on-site service, you may have your system repaired at an authorized ZDS dealer. Since ZDS depends on its dealers to support end users, it offers telephone support to dealers but not directly to end users. The company does not maintain a bulletin board. If your unit needs repair but you do not know where to find a dealer, you can call the ZDS Service and Technical Locator number (800-777-4630), which is available 24 hours a day. Zenith Data Systems also operates a forum on CompuServe.

Zenith Data Systems has produced innovative products in the past and continues to do so. For example, ZDS was first to produce a low-power notebook, the ZDS MastersPort 386SL. But our survey results indicate that users are not satisfied with the attention they get from dealers, who are responsible for service and support. ZDS and Bull HN need to rethink these policies.

FACT FILE

Zenith Data Systems, 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089; sales, 800-553-0331.

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CIRCLE 361 ON READER SERVICE CARD

ZEOS INTERNATIONAL LTD.

by Gayle C. Ehrenman

Zeos International may be last in the alphabet of our survey results, but its customers have a lot to celebrate, according to the results of our survey. Desktop users gave Zeos scores that placed it among the top-ranking companies in our four important categories. Laptop users favored Zeos nearly as much, granting above-average scores in the four survey categories.

Survey respondents rated Zeos's 286, 386SX, 386, and 486 desktop systems. The company's score for its product line placed it among the highest in overall PC reliability, with an above-average score of 9.08 out of a possible 10, alongside Gateway. Zeos also ranked very favorably (with Gateway again) on future likelihood of buying (8.58).

Zeos finally breaks through to the top on the question of satisfaction with repair service. The company finished with a striking score of 8.82 (Gateway was second at 8.73). Respondents were a bit less impressed with Zeos's technical support.

Zeos's 8.50 technical support score was significantly above the 7.48 average as well, but in line with Northgate, Swan, and Dell.

Owners of 386-based Zeos systems were most impressed with overall PC reliability, repair service, and technical support, but 486s are what Zeos owners are most likely to buy in the future.

Survey respondents rated Zeos laptops consistently near the top of the heap. The company's laptops placed first in overall PC reliability among manufacturers, with a 9.18 score that was significantly higher than the 8.59 average. But Zeos buyers are slightly less likely to buy another of the company's laptops. Here Zeos finished among the best (with a score of 8.28), along with Dell (8.53) and AST (8.33). All three scores are notably higher than the 6.87 average. And only Dell users (8.89) were more satisfied than Zeos customers with their repair service; Zeos scored 8.57, significantly above the 7.59 average. Scores for satisfaction with technical support were comparable. Here, too, Zeos (8.66) ranked alongside Dell (9.12),

well above the 7.52 average.

For the most part, Zeos's high ratings on our survey can be attributed to its service and support policies. The company provides the standard one-year warranty and 30-day refund guarantee, but it also offers warranty extensions for as long as five years, priced at 10 percent of the system cost per year. Zeos's general repair policy is that if you can handle a screwdriver, you can handle the repair. The company will ship you replacement parts overnight at its expense and will provide 24-hour technical support toll-free seven days a week to guide you through the repair. If you cannot wield a screwdriver, you can purchase an on-site repair contract for \$49 per year that gives you service from TRW, or you can use Zeos's on-line bulletin board. ■

FACT FILE

Zeos International Ltd., 530 5th Ave. NW, St. Paul, MN 55112; technical support, 800-228-5390; sales, 800-423-5891; fax, 612-633-1325.

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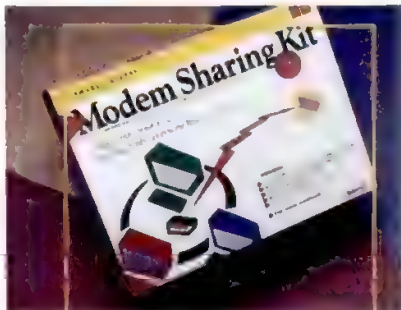
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models, Modem Sharing Kits quickly and easily allow dialing out to remote computers, and dialing in from anywhere off your LAN.

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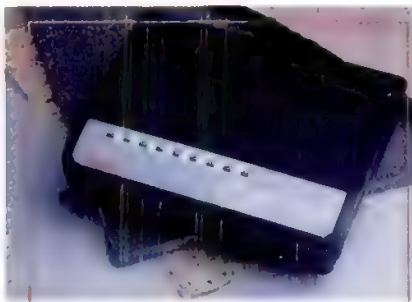
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Something Old, Something New

When you care more about what you want to say than about how it looks on the printed page, say it with a text-based word processor.

We evaluate nine DOS word processors that get the job done, usually faster than their flashier Windows counterparts.

by Edward Mendelson

Until a few years ago, text-based word processors were the only kind you could buy for a PC. If you wanted a graphically based program with screen fonts that looked like the fonts on the page, you had to buy a Macintosh. Today, graphical word processors that run under Microsoft Windows share the market with traditional text-based programs, but traditional programs still dominate sales and will probably continue to dominate business and professional desktops for years to come.

Text-based programs (also called character-based programs) have speed and efficiency advantages that graphical programs can't match in the current state of microprocessor and video technology. Gigantic files that make graphical programs stumble generally leave text-based programs unfazed. Text-based programs work effectively on computers that either can't run graphical environments at all or



PHOTOGRAPHY: THOM O'CONNOR

PC Magazine Looks at Nine DOS Word Processors

can run them only at a snail's pace. If your office has a few hundred XTs and a few dozen 486s, the only word processors that can run on all of them are text-based programs. Further, the keyboard-based interfaces, relatively small program size, and low disk space requirements of most text-based packages make them natural

choices for people who do much of their work on a laptop.

For this story, *PC Magazine* reviewed nine text-based word processors. The roster comprises five large-scale all-purpose packages—*Microsoft Word*, *Nota*

Bene, *Signature*, *WordPerfect*, and *WordStar for DOS*—and four smaller, more economical, but often sleek and effective, packages—*PC-Write Standard Level*, *Professional Write*, *Textura*, and *Word Writer Pro*.

Not all of these packages are entirely limited to character-based text. If your

DOS VS. WINDOWS WORD PROCESSING: Is the Beast More Efficient than the Beauty?

by Edward Mendelson

If you're looking for technical razzle-dazzle in your word processor, you probably don't want a text-based program. But that doesn't mean Microsoft Windows word processors are necessarily more efficient or more effective than their DOS-based rivals. You don't need a stopwatch to tell you that with Windows word processors it takes longer to enter text or jump from one screen to the next—operations that aren't measured by benchmark tests, but which affect your day-to-day productivity.

If you look at *PC Magazine's* suitability-to-task ratings for this story and compare them with the ratings for Windows word processors in the February 25, 1992, cover story, you might conclude that Windows word processors are more efficient at every task. But two less-than-obvious factors affect this comparison. First, DOS word processors excel at the unglamorous task of entering and editing text, which is only one part of the complex tasks measured by these ratings. For example, a proficient typist can easily outtype a Windows word processor, but can't keep pace with the DOS packages. Second, if you compare all Windows word processors with all DOS word processors, rather than comparing the best in both camps, you're comparing products launched within the past two years with products that have histories often as long as the PC itself.

Windows packages often look more efficient than their DOS rivals, but their efficiency can be skin-deep. For example, Windows applications use menus that comply with the CUA (Common User Access) interface standard. If you know to press F1 for help and Alt-F to open the File menu in one Windows

application, you can do the same in all of them. Most text-based word processors use idiosyncratic, hard-to-learn, function-key interfaces and menu systems that were created long before the CUA standard existed.

But despite the steeper learning curves of these non-CUA interfaces, they offer distinct advantages. For example, the Windows keyboard usually makes you perform keyboard acrobatics to choose an option with an Alt-letter key combination. In contrast, older-style menus often accept unshifted letter keys. The result can be a significant savings of time and effort in menu-intensive operations like spell-checking. *WordPerfect*, for example, lets you perform most of a spell-check by doing little more than pressing top-line number keys; *Nota Bene* lets you tap the Spacebar to accept a flagged word. Even the DOS version of *Microsoft Word*, whose menus generally work like the ones in *Word for Windows*, lets you spell-check with far less keyboard acrobatics than *Word for Windows*.

In virtually all text-based programs, you can touch a key to select a block, then use any cursor key or the search function to extend it. This convenience is missing from most Windows word processors, which require you to use a mouse or hold down the Shift key while you select text and don't let you use any menu functions to move the cursor while you select. *Word for Windows* and *WordPerfect for Windows* let you choose between the standard Windows method of selecting a block and the standard text-based method, but the result is more confusion than efficiency.

Windows clearly leads in automation and programmability. The most powerful Windows packages let you program complex merges without forcing you to

learn a programming language or type in codes. And if you decide to learn the programming language, you can automate complex tasks and exchange data with other Windows applications in smoother and more flexible ways than you can among DOS applications.

Many text-based programs, however, also allow powerful automation. The macro language in the DOS version of *WordPerfect*, especially when combined with the closely related macro language used by the DOS and LAN versions of *WordPerfect Office*, lets you automate tasks and write interactive menus in ways that approach the programmable integration of Windows—without the speed and RAM penalty of a GUI.

Most text-based word processors let you easily record the keystrokes that reach a menu. With macro languages in Windows word processors, you have to learn how to program before you can open a dialog box with a macro.

Text-based applications generally don't have the equivalents of Windows' dynamic data exchange or object linking and embedding, which let you alter data in one application and see the results instantly in a copy stored in another application. But *Microsoft Word*, *Signature*, and *WordPerfect* all have updatable "warm" links to spreadsheets and text files, and *Signature* even lets you create warm links with files created by major word processors that use completely different formats.

In the DOS version of *WordPerfect*, you can get help on any topic by pressing the help key and then the first letter of the topic. In *WordStar for DOS*, you can adjust the help system to your level of expertise. Don't even think of trying either trick in the help screens of Windows word processors. ■

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AUTOMATING THE TOWER OF BABEL: WYSIWYG's The Universal Word 2.02

With support for 75 languages—from Arabic to Zulu—this package looks like the total solution for the polyglot writer or editor.

by Bruce Brown

WYSIWYG Corp.'s *The Universal Word*, Version 2.02, is the word processor with something extra. You don't hear about it often because *The Universal Word* doesn't fit into standard product groupings. As a DOS graphical word processor, the program is something of a hybrid between Windows graphical word processors and DOS text programs. *The Universal Word*'s greatest attraction is not its proprietary graphical environment and WYSIWYG screen, however, but its impressive multiple language support.

The Universal Word is available in five single-language versions: English, German, French, Dutch, and Italian, each priced at \$449. In an effort to build its user base, WYSIWYG is running a competitive crossover program through September 1992. Anyone can purchase *The Universal Word* 2.02 single-language English version for only \$95 just by calling the folks at the company and telling them that you currently use another word processor.

MULTILINGUAL

WYSIWYG currently has word processing support for over 75 different languages. The multiple-language versions of *The Universal Word*, all of which include English, range from the 4 \$495 bilingual versions to collections of up to 41 languages at \$695.

The single-language versions are not copy-protected, but the multiple-language editions include a parallel port security device (commonly known as a dongle) that must be plugged in before the program can be installed or run. (This security measure is included at the insistence of WYSIWYG's international distributors.)

Whether you buy a single- or multiple-language version of *The Universal Word*, you'll find the package pleasant to work with and fairly easy to use. The

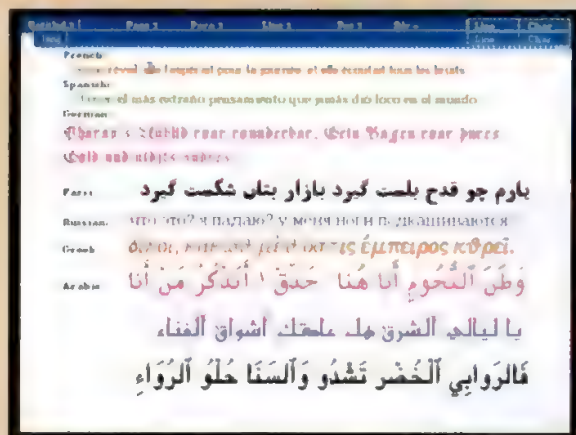
proprietary graphical environment encompasses the menus, the help screens, and the on-screen text area. By controlling both the display and printer drivers, WYSIWYG manages to have the on-screen text display look just like printed output. While important with any language, it's even more significant when working in multiple languages with varying character sets.

The menu system, driven via mouse or single-letter commands, uses a horizontal main menu with pull-down option menus. When a pull-down menu selection leads to more options, additional choice lists pop up to the right of the original; you can always see the menu path you followed. For some functions, such as setting system defaults, the program uses comprehensive pop-up dialog boxes.

The Universal Word allows unlimited multiple text windows. You can control window size, proportion, and location; so you can have the windows overlap, cascade, or tile. Changing window size and location is easily accomplished with the mouse. You can completely customize the colors, font sizes, and, in the multiple-language versions, even the languages that are used in each window.

TOTAL CONTROL

Perhaps the greatest tribute to *The Universal Word*'s WYSIWYG capabilities is that every line, word, or character in a text window can have its own color, font, size, and language. The single-language English version comes with 9 standard scalable fonts that can be set



The Universal Word's multilingual versions support multiple languages, fonts, text direction, and even colors in the same document.

from 2 to 100 points. Support is included for more than 400 printers, including color models.

The multiple-language versions of *The Universal Word* allow you to control menu and help screen languages as well as the languages that are used when you type or edit text. While the company can customize the program with a number of language configurations, the normal setup for the 41-language version includes menus and help screens in English, French, Dutch, German, and Arabic.

Many of the languages supplied by WYSIWYG use the same fonts provided with the English version of *The Universal Word*. For those languages that use other character sets, such as Arabic, Farsi, Greek, Hebrew, Russian, and Urdu, language-specific fonts are included. For example, there are ten Arabic fonts and three Hebrew fonts. Selectable language direction supports both left-to-right and right-to-left typing.

The Universal Word manual includes keyboard layouts for each language, with your choice selected during program setup. In some cases, there is more than

one keyboard layout choice for a single language. Keyboard templates are available for the major languages that are included with the program.

JUST BASICS

The Universal Word has a spell-checker and thesaurus, and supports both parallel and snaking columns. But the program doesn't have many common, high-end word processing features. For example, *The Universal Word* does not support programmable merges, macros, outlining, automatic hyphenation, footnotes/endnotes, indexing, table of contents, numeric and table functions, or sorting. The program can import a wide variety of word processing, ASCII, and spreadsheet file formats, but graphics file importing is limited to monochrome .PCX and TIFF.

On PC Magazine Labs' performance tests, *The Universal Word* was quite slow compared with most of the other DOS word processors we tested. Its performance was also somewhat slower overall than the Windows word processors reviewed in our February 25, 1992, cover story. The proprietary graphical environment credited with *The Universal Word*'s highly flexible text presentation capabilities has to take the responsibility for the slower performance on the tests.

Clearly, if you need to work with more than one language, *The Universal Word* should be on your list; the level of multiple-language support the program provides is most impressive. If you are only looking for an English-language word processor, *The Universal Word*'s WYSIWYG capabilities are also notable. But the program's lack of speed, high-end features, and automation abilities makes it a dubious choice—especially considering the price tag. ■

The Universal Word, Version 2.02 WYSIWYG Corp., 5959 W. Century Blvd., Penthouse floor, Los Angeles, CA 90045; 800-776-7674, 310-215-9645. **List Price:** Single-language version, \$449; multiple-language versions, \$495 to \$695. Until September 30, the English version is offered for \$95. **Requires:** 640K RAM, DOS 3.0 or later.

CIRCLE 486 ON READER SERVICE CARD

video card is anything other than an old-style monochrome display adapter, all but one let you switch to a graphical preview of the printed version of either a full page or two facing pages; *WordStar* also lets you view thumbnail images of multiple pages. These preview screens are generally uneditable; you can look but not touch. Some, instead of providing legible text, indicate only the area of the page the text will occupy. *Signature*, in contrast, optionally displays a non-Windows-based graphics editing screen that uses WYSIWYG fonts. Some text-based programs let you import graphics images and modify their scale, orientation, and proportions, but you'll need Windows for flexible, directly manipulable graphics.

WARP-SPEED WRITING

If you choose a character-based program over a graphics-based one, it's probably because you prefer speed to the menu-based hand-holding you can get from most Windows applications, and because you don't want to be distracted by fonts and formatting when you prefer to think about words. Most character-based programs let you work in a relatively clean screen, with at most one or two lines lost to menus and status lines. *Microsoft Word* and *WordStar* let you eliminate all menus, leaving your document in sole possession of the screen. If you use an EGA or VGA monitor, you won't be limited by the original IBM standard of 25 lines of 80 characters each, because many text-based programs let you select fonts built into your video adapter that give you as many as 60 lines of text up to 144 characters wide.

Several text-based word processors support a mouse, but, with the exception of *Microsoft Word*, their hearts aren't in it. You'll probably control your text-based program entirely from the keyboard, and you'll probably prefer a program whose keyboard layout is rich in shortcuts and open to easy customization. Programs like *Nota Bene*, *Textra*, and *WordPerfect* let you use a simple menu to remap their keyboards and attach macros to keys. Programs like *Microsoft Word*, *PC-Write*, and *Signature* offer similar flexibility with a bit more effort.

You may find that the menus in many text-based programs, which were designed to be navigated by the keyboard alone, let you work more efficiently than you do in Windows, which allows menu designers

to get lazy, letting the mouse make up for the shortcuts that should be provided through efficient menu design.

OLD CODES VS. NEW PAINT

Word processors use two basic methods of formatting text. Most character-based programs use embedded codes to turn format settings on and off. In *WordPerfect*, for example, when you go to the Format menu and switch from single-spaced to double-spaced text, the program inserts a line-spacing code at the point where the change takes place. If you want to return to single-spacing at a later point, you have to move the cursor to that point, and use the menu to insert a second line-spacing code. Programs like *Signature* and *WordStar* use similar codes, but give you the option of bypassing the menus and inserting them directly in the text, where you can edit them directly.

Microsoft Word pioneered an entirely different method. In *Word* (as in *Word for Windows* and most other Windows word processors), if you want to apply page formatting to the whole document, you don't have to be careful to go to the top of the file and insert a code. You simply apply page formatting anywhere in the document and it applies to the whole. If you want to set the format for part of the text, you simply select or define a block, choose a format command from a menu, and apply formatting like a coat of paint. If you want to change page margins for the whole document, you don't have to move the cursor to the top of the file; the program understands that your choice applies to the whole document, or to the current subdivision of the document, no matter where you put the cursor.

Neither format method is inherently superior. Code-based programs give you more precise control over the exact point where a format setting begins and ends. But programs that apply formatting like paint save you the trouble of entering two sets of codes whenever you want to change the format in a small part of the document. *Signature* is a unique example of a code-based program that also lets you "paint" a formatting region; it's smart enough to insert the codes you want at the end of the region as well as at the beginning. Other code-based programs may incorporate similar intelligence in the near future.

WRITING STYLISHLY

One way to ease the tedium of entering codes or filling in menus is to use styles.

This feature, also pioneered by *Microsoft Word*, lets you define a complex set of formatting commands by a single name like "Main Heading," and apply the full set of commands in one step by choosing the style. Many code-based programs now support styles, but these are generally more awkward to use than styles in programs that define format by painting the text.

DOS-based programs differ drastically in their handling of add-on fonts, and each handles fonts slightly differently. The character set that *Microsoft Word* expects to find in a font is not necessarily the same

as the character set that *WordPerfect* expects, and if you use soft fonts in multiple DOS applications, you may need to keep different versions of the same font on your disk. Windows has more limited font support, but at least all programs use the same fonts and the same printer driver. If you expect to work with soft fonts, find out from the font vendors whether they support the program you choose, or make sure the program itself can adapt easily to any font. Right now, no program reviewed here handles all fonts effortlessly, but the

next major version of *WordPerfect* reportedly will include universal font support.

All text-based programs have their awkward patches, which are generally different than the awkward patches in Windows applications. Many text-based programs have interfaces that don't correspond to the interfaces in other software you use, and some force you up a relatively steep learning curve, compared with the gentler slopes you face in Windows. Although once you've reached the peak of the learning curve, you can then move at top speed—as you never can in Win-



EDITORS' CHOICE

■ *WordPerfect*

No single DOS word processor can be ranked as the absolute best. The program with menus for occasional users is never the program that lets experts get the job done fastest. And the program with the best graphics and layouts probably won't be the one with the most shortcuts for writing and editing. Three full-featured word processors stand out from the competition for their varying but generally strong features, speed, ease of use, and customizability. Not surprisingly, they are three of the same packages that won Editors' Choice designations when *PC Magazine* last surveyed the whole field of DOS word processors in 1988.

Our Editors' Choice, *WordPerfect 5.1*, deserves its title as the corporate standard. Its range and depth of features are unmatched among DOS word processors, with strong support for legal applications, an intuitive table editor, well-designed links to spreadsheets, and powerful document management. It also has the widest support from third-party add-ons, especially for networks, and is the only DOS word processor that transparently shares files with its Windows and Macintosh versions. *WordPerfect's* printer drivers surpass anything else on the market, and its toll-free help sets a standard that embarrasses the rest of the industry. And because *WordPerfect* is its company's

flagship product, you can anticipate major advances in forthcoming versions.

The program isn't perfect, of course. It lacks collapsible outlining and suffers from awkward stylesheets and an interface that's a mix of clarity and confusion. The keyboard layout keeps everyone but experts dependent on the plastic template. Winston Churchill said that democracy is the worst political system ever invented, except for all the others. Something like that could be said about *WordPerfect*. For all its minor problems, if you need to get the job done, *WordPerfect* can almost certainly do it.

Microsoft Word 5.5, an honorable mention, excels in almost every area where *WordPerfect* lags. Its stylesheets are more elegant and flexible than anything else available under DOS or Windows, and its collapsible outlining is the best available under DOS, now that Lotus has stopped marketing *Manuscript*. *Word 5.5* currently comes in two versions with different interfaces on two different sets of disks: *Word* loyalists can continue with the old interface or switch to the simpler and more flexible Windows-like interface introduced in this latest release. *Word* is fast and efficient, but you don't get the printer support you find in *WordPerfect*, and Microsoft seems to be less committed to building on this package's strengths

than it is to developing *Word* for Windows.

Another honorable mention, *Nota Bene*, which has never been marketed as effectively as it deserves to be, surpasses both *WordPerfect* and *Word* as a program for entering and editing text. No other program makes it so easy to manipulate words, sentences, and paragraphs. And no other program currently on the market lets you manage large projects so easily: It reopens all open files from your previous session (or any saved session) and repositions the cursor exactly where you left off work. *Nota Bene* also has unique links to text-database, bibliographical, and foreign-alphabet add-ons that let you manage data in multiple languages with ease. The whole program builds on its speedy *XyWrite* engine, but adds elegance and conveniences never found in *XyWrite* itself.

Two other packages deserve attention for specialized uses. *Signature*, the successor to *XyWrite III Plus*, lets you assemble documents with warm links to files in a wide variety of formats, and lets you switch to an editable WYSIWYG mode that doesn't use Windows. It's rich in features, but it's not user friendly. *Textra*, a low-priced marvel, has much of the power and speed of full-featured packages at a fraction of the price.

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CIRCLE 280 ON READER SERVICE CARD





RATING THE PRODUCTS: SUITABILITY TO TASK

We evaluated character-based DOS word processors according to the same Suitability to Task criteria we used in our February 25, 1992, review of graphical word processors. No DOS package achieved a rating of 4 in any of our task categories. *WordPerfect* was the strongest DOS performer, with ratings of 3 across the board.

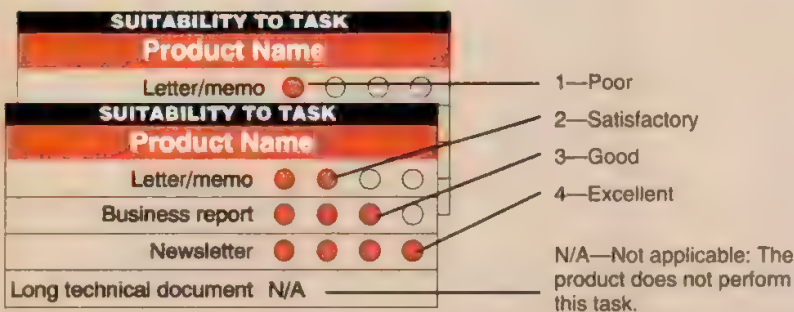
Letter/memo evaluates the program's macro language, its templates (stylesheets), and the completeness of its mail-merge functions, including label printing.

Business report assesses the program's ability to import graphics, create a bullet list, set up data links to spreadsheets, check spelling and grammar, create and edit tables, and facilitate redlining and group editing.

Newsletter evaluates text-column layout flexibility, text flow, preview modes, font-spacing features, and importing and editing of EPS and TIFF graphics files. It also tests

the drawing tools, if any are included with the program.

Long technical document more rigorously tests the program's templates, including the creation of styles for headers/footnotes, tables of contents, and indexes. Other considerations include file management, which allows creation of master documents, subdocuments, and wide-area searches, as well as manuscript preparation features such as tables of contents, indexing, automatic cross-referencing, equation editing, collapsible outlining, and footnote/endnote creation.



dows. By holding your hand, Windows also holds you back. If you want to get the job done quickly, and you want to concentrate on the job itself instead of a screen full of icons and scroll bars, one of the text-based word processors profiled in the following pages should be the only program you need.

Microsoft Word

by Edward Mendelson

Microsoft Word combines the speed and efficiency of text-based word processing with the convenience of the best Windows programs. Version 5.5 of Microsoft's \$450 word processing flagship even looks like a text-based copy of Windows, complete with a CUA-compliant menu system and up to nine editing windows that you can move and resize with the mouse. If you don't want your word pro-

cessor to look like Windows, *Word* is one of the few programs that gives you the option of an absolutely clean screen with no borders or menus. Compared with *Microsoft Word for Windows*, DOS *Word* has more automated control over format-

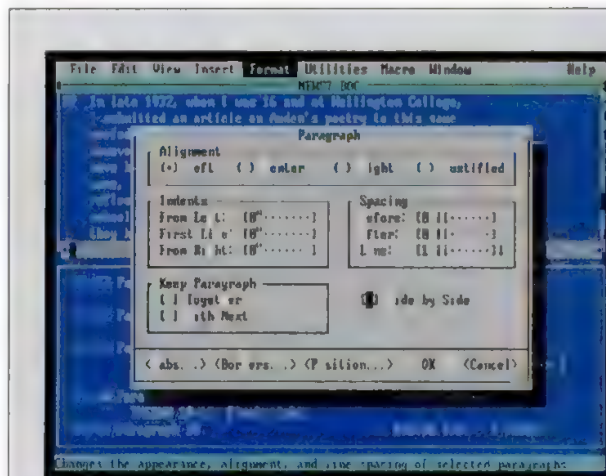
ting text; for example, it lets you create styles for characters as well as for paragraphs. But the DOS version can't create tables, and its graphics support is cruder than that of DOS *WordPerfect* and most Windows programs.

Word was the first word processor without formatting codes. Instead it lets you define a block of text and apply formatting to it—now the standard method used in most Windows word processors, but still unusual among text-based programs. *Word* now does use codes for indexing, graphics, and some other features, but no format codes are visible in your file. If you want to see what formatting applies at any point in the file, you can look at the formatting ribbon at the top of the screen, or at more detailed sub-menus.

EASY CONTROL

A keystroke switches from text-based fonts to graphics-mode fonts that display italic, strike-through, and small caps, but to see graphics and a full-page layout, you must switch to *Word*'s small-scale print preview. *Word* optionally wraps long lines at the edge of the screen instead of scrolling off the edge, and (as with *Word for Windows* and *Textra*) you can edit different parts of the same file in separate windows. Footnotes can be viewed in a window that scrolls in step with the main text. *Word*'s collapsible outlining is fast and elegant.

Word's styles are the easiest to create and manage of any text-based word processor and make the program ideal for producing documents with complex standardized formats. Combined with a hidden text feature, stylesheets will let you create full and summary versions of the



In the background are a *Word* document and a *Word* stylesheet, both of which can be displayed on the same screen with *Word*'s new Windows-like interface. In the foreground is *Word*'s straightforward menu for advanced paragraph formatting.

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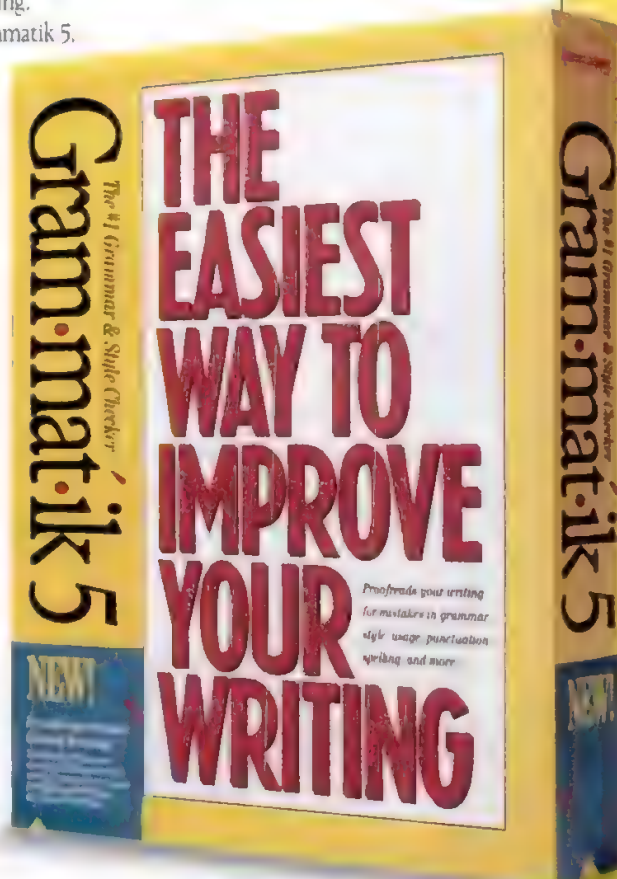
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SOFTWARE

DOS WORD PROCESSORS

same file automatically. But *Word*'s support of foreign and technical characters is weak—you have to write macros or remember Alt-number codes to access them—and footnote numbers restart whenever you begin a new section to alter page formatting. *Word*'s glossaries expand abbreviations or run macros at a keystroke. A supplied macro is supposed to handle envelope printing, but we never got it to work, and a bug in the current

SUITABILITY TO TASK				
Microsoft Word				
Letter/memo	●	●	●	○
Business report	●	●	○	○
Newsletter	●	●	○	○
Long technical document	●	●	●	○

copy of the LaserJet drivers sometimes prevents background printing from occurring.

A bookmark feature lets you find or cross-reference text blocks of any size. *Word*'s line sorting is primitive, but its document management, though less extensive than *WordPerfect*'s, is effective for corporate use. You can redline on the fly, but you can't compare two versions of a file. On-line help is less extensive than *WordPerfect*'s and should be supplemented with Alki Software's \$59.95 *MasterWord* (800-669-9673), which includes a control panel that lets you cus-

tomize every aspect of *Microsoft Word*'s appearance.

UPGRADE MATTERS

In Version 5.0 and earlier, *Word* had a look and feel like no other word processor on the market, with first-letter menus that you accessed via the Esc key. The upgrade to Version 5.5 added few functions beyond a word count, but introduced the up-to-date menu system, dialog boxes, format ribbon, and more flexible windowing. Some longtime users were unhappy with the change, so Microsoft now provides a choice: When you buy 5.5, you also get 5.0; you can use either or both. Except for its well-implemented styles and outlining, *Word* isn't as powerful or as feature-rich as *WordPerfect*, but it's more logically organized—and in speed tests, these two market leaders are neck and neck. If you want to create structured documents with standardized formats, nothing does the job with more ease and elegance than *Word*.

Nota Bene

by Edward Mendelson

While every other major word processor scrambles to add graphics support and WYSIWYG previews, *Nota Bene* retains its single-minded loyalty to the word. This \$449 package, from N.B. Informatics, began as a specialized academic word processor built around the XyWrite engine. But it developed into a program with unparalleled convenience and efficiency for anyone who writes. Other high-end programs equal or surpass its ability to manage complex formats and multiple fonts, but no other program offers so many effective and ingenious shortcuts for writing and managing text.

In many ways, *Nota Bene* is the program *Signature* should have been. Both build on the XyWrite engine; both let you use drop-down menus or a command line; but where *Signature*'s menus are awkward and confusing, *Nota Bene*'s are lucid and elegant. *Nota Bene* gives you the quickest control of any program over words, sentences, and paragraphs: One keystroke deletes, transposes, or defines them as a block. After using this keyboard layout, all others seem constraining. *Nota Bene*'s five-level undelete feature—

unmatched among other DOS-based programs—lets you recover strings of words deleted in sequence, and even lets you extract selected characters from a deleted string.

MANAGE WITH EASE

Nota Bene lets you open as many as nine text windows and scroll through two of them simultaneously. No other DOS-based word processing program lets you save and recover multiple files with so little effort. A FilePad lets you select with a keystroke from a list of nine files that you use often. Another *Nota Bene* menu selection lets you reopen any file opened earlier in a session, or, optionally, in earlier sessions.

When you finish an editing session, *Nota Bene* remembers the files and cursor positions in all windows and will restore them when you start again. You can even save nine different sessions and restore whichever one you choose. A search path for data files lets the program open any file you name automatically, even if you can't remember its directory.

Nota Bene also remembers your last ten search-and-replace strings and allows you to scroll through them either in tandem or separately. Similarly, the command line lets you scroll through ten previous commands. A compose feature, easier to use than *WordPerfect*'s, lets you enter any supported character without looking up codes. The package's extensive remapping utility, equalled only by that of *WordPerfect for Windows*, allows you to make the keyboard behave the way you want it to.

Nota Bene lets you automatically at-



Microsoft Word, Version 5.5

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080.

List Price: \$450.

Requires: 384K RAM (512K recommended), DOS 2.0 or later or OS/2 1.0 or later.

In Short: *Microsoft Word 5.5* is one of the few text-based word processors worth considering for office or professional use. It excels in its style handling and collapsible outlining, and its new Windows-like menu makes it convenient for newcomers—although users of earlier versions may find the change more trouble than it's worth.

CIRCLE 408 ON READER SERVICE CARD

SUITABILITY TO TASK				
Nota Bene				
Letter/memo	●	●	●	○
Business report	●	○	○	○
Newsletter	●	○	○	○
Long technical document	●	●	●	○

tach stylesheets to documents with specified filename extensions (for example, attach the style LETTER to all files with the extension .LTR). You can't mark a block of text and apply a style as you can in *Microsoft Word*, but other aspects of style management are flexible and straightforward. *Nota Bene*'s code-based formatting can often be fussy and difficult to manage, but the program gives you unique conveniences such as a menu that

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Automatic Emulation Switching	No	Yes	Yes	Yes
Enhanced Resolution Technology	Yes	No	No	Yes
Automatic Interface Monitoring	No	No	No	Yes
Envelope Feeder & Cassette	No	No	No	Yes
Suggested List Price	\$2495	\$1995	\$2249	\$1749

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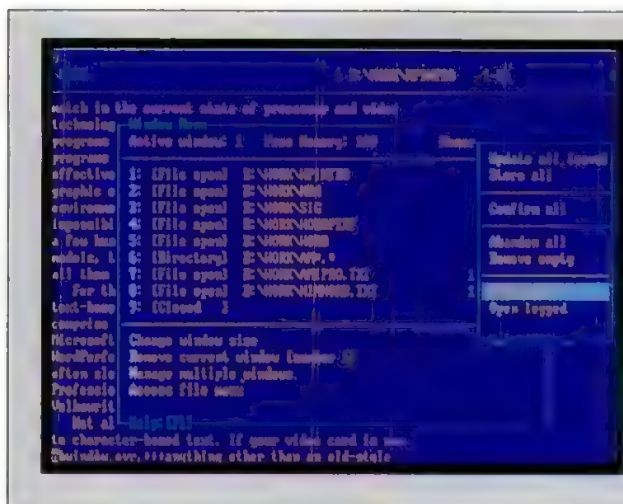


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CIRCLE 026 ON READER SERVICE CARD



Nota Bene's menus often give you every imaginable option.

The envelope printing menu lets you choose from preset or custom envelope sizes and from a variety of address formats. Unlike most drop-down menu systems, *Nota Bene's* always uses the first letter of a menu item as a shortcut.

PC-Write Standard Level

by Bruce Brown

Not everyone needs or wants a high-powered word processor. For personal use, and even for many simple business word processing tasks, the program that requires multiple megabytes of hard disk space, hundreds of pages of documentation, and yards of feature menus often misses the point. Quicksoft's *PC-Write Standard Level* 2.0 is available as a \$129 retail package or—minus the documentation and the thesaurus—as shareware. This package, long popular for its value, availability, simplicity, and portability, may still be a good choice for many beginners and even for more advanced PC users who want to control the way their word processor works—an area in which *PC-Write* shines.

As a DOS text-mode program, *PC-Write* performs usual tasks with reasonable speed. You don't get WYSIWYG font display, but the lack of on-screen precision pays off in quicker document

lets you view and select all the headers and footers used in a file.

FACES AND PRINTS

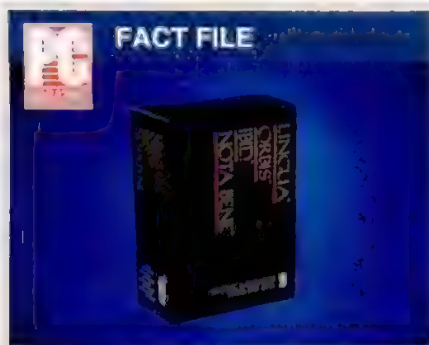
Typefaces are identified by number in format codes, although you select them by name from a menu. You can specify linked typefaces that print instead of the specified faces when you change printer drivers; this feature lets you choose between printing in proportional or draft-style monospaced with a few keystrokes. Font support includes easily customizable drivers for any combination of LaserJet bitmap and scalable soft or cartridge fonts, and you can install PostScript fonts automati-

cally. Agfa's CG Times (the new improved version) and Univers typefaces come with the package; and a supplied utility lets you generate bitmapped soft fonts or scalable fonts if your printer supports them.

Nota Bene is the only code-based word processor to offer collapsible outlining. (Unfortunately, the program litters your file with format codes at the start of the outline.) The program provides automatic printing of seven predefined envelope sizes and a choice of four different return address styles. Although you can redline on the fly, you can compare two files only by pressing keys that find points of difference and similarity. Single keystrokes split the screen horizontally or vertically to make such comparisons easier. A free upgrade disk, due by the time you read this, will add file converters from *WordPerfect* and *DOS Word* and a recorded-keystroke feature to improve on the text-only macros currently available.

For heavy-duty and academic writing, *Nota Bene* offers three integrated add-on packages: *N.B. Orbis* (\$199) provides fast indexing and retrieval of thousands of files; *N.B. Ibid* (\$199) adds advanced bibliography formatting; and *N.B. Lingua* (\$299) builds in support for all European Roman and Cyrillic alphabets, plus Greek and Hebrew, complete with screen and printer fonts.

Nota Bene isn't for anyone who needs graphics or a widely shared corporate standard. But if you need to create and retrieve text quickly, especially if you work with large numbers of files, no other program does the job with such single-minded skill and attention to detail.



Nota Bene, Version 4.0

N.B. Informatics, 285 W. Broadway, #600, New York, NY 10013; 800-969-6922, 212-334-0445.

List Price: \$449; discounts available for academic and nonprofit groups.

Requires: 640K RAM, DOS 2.0 or later.

In Short: This is a superb program for creating and editing text and for managing multiple files and directories. *Nota Bene's* special features for academic and research use don't get in the way of its efficient keyboard layout. Add-ons provide text-based management and multilingual support. If you need graphics, though, look elsewhere.

CIRCLE 467 ON READER SERVICE CARD

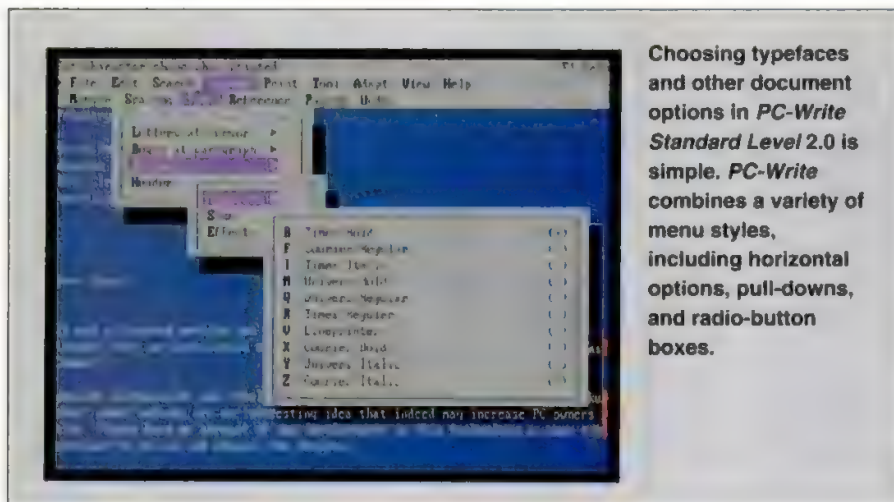
SUITABILITY TO TASK				
PC-Write Standard Level				
Letter/memo	●	○	○	○
Business report	●	○	○	○
Newsletter	●	○	○	○
Long technical document	N/A			

loading. You can't scroll or print documents particularly quickly, however; the program is by no means a speed demon.

The package comes with a 50,000-word spell-checker that can be set to indicate misspellings as you type—by beeping at unrecognized words. The retail version of *PC-Write* also has a thesaurus that provides definitions and synonyms. A quick text-analysis feature reports on file size as well as character and word counts.

THE BASICS

Standard editing tasks such as navigating through documents, changing text, and marking blocks to copy, move, delete, or reformat, are all easily accomplished via menus, mouse movements, and speed keys. Simple page-layout settings such as margins, line spacing, headers and footers, and typeface choices are easily se-



Choosing typefaces and other document options in *PC-Write Standard Level 2.0* is simple. *PC-Write* combines a variety of menu styles, including horizontal options, pull-downs, and radio-button boxes.

lected from pull-down menus. *PC-Write* supports over 800 printers, including PostScript models. The program's print preview mode displays the page contents as gray blocks, not readable text.

The software lacks advanced features like collapsible outlines, table of contents generation, sorting, and table editing. Unfortunately, it also lacks some not-so-advanced features such as columns and automatic hyphenation. You won't find stylesheets in *PC-Write* either, but the ease with which you can customize the user interface and system- and document-

format defaults surpasses many more expensive programs.

HAVE IT YOUR WAY

PC-Write's command menus behave very much like those in Microsoft Windows: If you prefer to use the keyboard instead of the mouse, you access individual option menus with Alt-key combinations followed by single keystrokes for specific commands. *PC-Write*'s command organization doesn't mimic that of Windows, however. For example, printing has its own pull-down menu rather than appearing on the File menu.

PC-Write boasts particularly strong customization capabilities. You can do command-menu surgery either with a chain saw or with a scalpel. First of all, the package offers menus in three strengths—beginner, intermediate, and advanced—so you can broadly select the level of command detail. If for some reason these standard menu configurations don't meet your needs, you can customize any of them by deleting commands you don't need or don't want others to see. In this way you tailor menu structure to the way you work.

System- and document-default controls are impressive, too. Without ever leaving the program, you can change default settings for editing options such as date formatting, pagination, line spacing, screen colors and video modes, keyboard feel and key assignments, and even file-handling settings such as timed backups and file conversion types.

PC-Write has simple keystroke-recording macro capabilities, useful for commonly entered text or formatting com-

mand settings. Macros can be temporary, or can be assigned to keystroke combinations and saved. Once saved, they cannot be edited, however.

PC-Write handles import and export only of ASCII, *WordPerfect*, and DCA format files. And while it cannot import or manipulate graphics, the program does support simple line drawing, so you can surround text with boxes. *PC-Write*'s merging facilities are basic, though simple to use. (There are no programmable or conditional merge functions.) Merge files can use either comma-delimited or line-delimited ASCII file formats.

With its lower-than-average system requirements, *PC-Write* is a good bet for owners of laptops or older desktop systems with limited memory or hard disk space. It can appeal to word processing novices looking for a relatively inexpensive program to handle basic writing and editing tasks, or those who want to set up streamlined menus and custom document defaults. It's not a good choice for desktop publishing or highly automated word processing tasks.

Professional Write

by John R. Quain

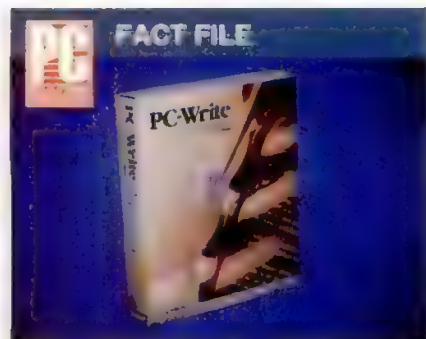
Software Publishing Corp.'s \$249 *Professional Write* is now six years old, certainly no youngster by software industry standards. Corporate customers, however, may feel the product still has some maturing to do.

Professional Write is intended for managers who need to generate memos, letters, and reports—and it's this mind-set

SUITABILITY TO TASK				
Professional Write				
Letter/memo	●	●	●	○
Business report	●	○	○	○
Newsletter	●	○	○	○
Long technical document	●	○	○	○

that is part of the problem. The program is strong on features that reflect "management-style word processing" but it has no special functions for dealing with large technical documents or desktop publishing tasks.

Professional Write's down-to-business interface displays a list of pull-down menus across the top of the screen and a ruler/status bar along the bottom. Menus are accessed via function keys. There is



PC-Write Standard Level, Version 2.0
Quicksoft Inc., 219 First Ave. North, #224,
Seattle, WA 98109; 800-888-8088, 206-282-
0452.

List Price: \$129.

Requires: 384K RAM, DOS 2.0 or later.

In Short: *PC-Write Standard Level 2.0* remains a fine program for personal word processing for both novices and more advanced users who don't need the features or want the bulk of higher-end packages. *PC-Write* lets you set extensive document defaults and customize its menus to include only the features you use.

CIRCLE 408 ON READER SERVICE CARD

SEVEN MYTHS ABOUT DOS WORD PROCESSORS

by Edward Mendelson

If you're feeling like a second-class word processing citizen because (according to popular wisdom) Microsoft Windows' word processing power leaves your DOS program in the dust, be comforted. While they are often more idiosyncratic in their approach and less elegant in their appearance, DOS-based word processors have been performing many Windows-like feats for years. Here are the seven most widespread misconceptions about the limits of DOS-based word processors, followed by the sometimes-surprising reality.

Myth: DOS programs can't handle graphics.

Reality: Most DOS-based word processors do support graphics; some do it with great flexibility. *WordStar for DOS* supports over 25 different graphics file formats. *WordPerfect*, though it supports fewer formats, gives you as many manipulation options as you get in most desktop publishing programs.

If you use WordPerfect Corp.'s *Office* and *DrawPerfect*, you can select a graphic in your *WordPerfect* document, jump directly to *DrawPerfect* to edit the graphic, then jump back to *WordPerfect* and see the results immediately in your file.

Myth: You can't use a mouse with DOS programs.

Reality: *Microsoft Word* was designed from the ground up to use a mouse; the first version of *Word* even shipped with a mouse in the box. *Word* uses a mouse to select text, resize windows, and scroll through a document without touching the editing cursor. *PC-Write*, *Signature*, *WordPerfect*, *WordStar*, and *Word Writer Pro* also support the mouse, although less extensively.

Myth: DOS programs can't handle columns.

Reality: Most DOS-based word processors handle columns and many have strong column features. The best of the lot, *WordPerfect*, gives you column support equaled only by *WordPerfect*

for Windows. You can set up parallel columns that extend from one page to the next, as well as the more common snaking columns. *Nota Bene* and *Signature* even give you footnotes in columns.

Myth: DOS programs don't let you see italic or special characters when you edit.

Reality: *Microsoft Word* lets you edit in a graphics mode that isn't WYSIWYG, but uses monospaced screen fonts with italic, small caps, underlines, and other text attributes. *WordPerfect* lets you select a screen font that uses italic, and an optional Screen Font Editor lets you customize your *WordPerfect* editing screen fonts to include any character you want. *Signature* gives you full WYSIWYG editing, but you switch out of character mode to get it.

Myth: DOS programs don't let you open multiple documents at the same time, and they don't remember the files you worked on last.

Reality: All but one of the products we review (*Professional Write*) let you open at least two documents. *Textura* expands the number to eight. *Microsoft Word*, *Nota Bene*, and *Signature* each let you keep nine files open at once; *PC-Write* makes it ten. *Nota Bene* also lets you save your complete workspace of nine files and open the same nine files at any time later.

Myth: DOS programs don't let you exchange data as you can with Windows DDE and OLE protocols.

Reality: *Microsoft Word*, *Signature*, and *WordPerfect* all give you warm links between text files and spreadsheets. Change the data in the spreadsheet, reopen the word processing document, and the revised data appears in your spreadsheet.

Myth: DOS programs don't let you edit tables.

Reality: *WordPerfect* has an interactive table editor that lets you move margins and borders with the Ctrl-arrow keys. ■

no mouse support, but shortcut key combinations are included. A recording option allows you to create macros.

BUSINESS WRITING FEATURES

Among the package's strong suits is its wide conversion support for other popular word processor formats. Users can import or export files from *Lotus 1-2-3*, *Microsoft Word*, *OfficeWriter*, *Wang PC*, *WordPerfect*, and *WordStar*. Only one graphics file format can be imported into text, however, that of SPC's own *Harvard Graphics*.

SPC has also integrated the *Grammatik IV* grammar checker into *Professional Write 2.2*. Its proofreader can be customized for specific business styles. A 77,000-word dictionary is included for spell-checking, along with a 20,000-word thesaurus.

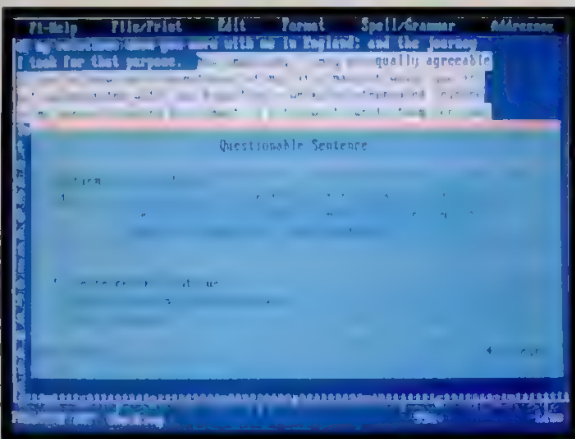
One particularly convenient feature of *Professional Write* is its address book. This utility allows you to enter names, addresses, phone numbers, and so forth, into a form template. One function of the address book is to record mail-merge data; you can also transfer single addresses directly from the address book into your documents. Several address books can be created and used in this fashion. Mail merges can also be performed using delimited ASCII or dBASE files.

NO SPEED DEMON

Professional Write does not win high marks for sheer editing speed. In fact, among the packages reviewed here, it was one of the slowest in loading documents, and fared little better in search-and-replace tasks. Scrolling speed was also a little off the pace; printing times were good to average.

For printing tasks, *Professional Write* offers a page preview with both a full-page view (which displays greeked text, which is unreadable, but is handy for judging layouts) and a legible close-up view. While you can change fonts in preview mode, you can't edit text.

Despite its positioning as a general business tool, *Professional Write* still lacks several desirable features. Those who have ever lost a day's work by forgetting to store a document will be disappointed that a timed automatic save function isn't included. Users are also restricted to working on one document at a time. When you want to move a block of text from one file to another, a clipboard holds the highlighted text in memory while you close



Professional Write 2.2's integration of the *Grammatik IV* proofreader and grammar checker should attract business users looking to polish their prose. The proofreader function allows users to specify particular parameters and customize *Grammatik*.

one file and open another. Managers looking for a package that allows several individuals to work on the same document will be disappointed to discover there's no redlining feature.

Other minor nuisances include the search-and-replace function: There's no looking back with *Professional Write*. It will only search ahead in a document. If the word or string appears early in the document, you'll have to scroll back to the first page.

BUSINESS ONLY

Academics, authors, and wordsmiths in general should look elsewhere to fill their

word processing needs. The package provides no footnote or endnote options, for example, and indexing, cross-referencing, and table of contents tools are absent. And aside from a simple line-drawing utility, *Professional Write* offers nothing resembling desktop publishing capability.

All in all, this release of *Professional Write* does offer some important improvements. In particular, the program's former maximum file size limit of 64K is gone. A single file can now occupy up to half of the available hard disk space. There is also broader printer support, with drivers for 160 printers, including PostScript and the latest Hewlett-Packard LaserJet models. *Professional Write 2.2* qualifies as an easy-to-use package that meets a number of business needs. The trouble is, it just doesn't meet enough of them.

Signature

by Edward Mendelson

Xyquest's \$495 *Signature* has a split personality. It's the only word processor that can switch between a DOS character-based editing mode and a true graphical WYSIWYG editing mode—and let you display one file in either mode on the same screen. It is also one of the few word processors that you can control either from a command line or from drop-down menus. You switch between the two interfaces with a keystroke. *Signature* lets you interact with it in more ways than you can with more single-minded applications, but like any split personality, it responds in ways

you may not always expect or appreciate. It's uniquely powerful, but erratic and inconsistent.

UNUSUAL HISTORY

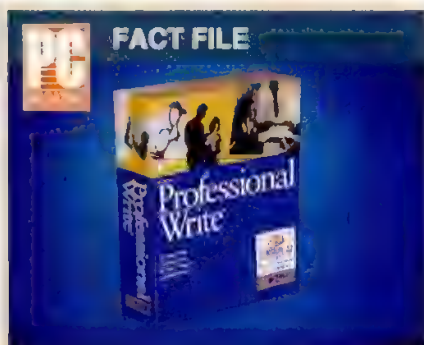
Signature got its divided personality from its now divorced parents, IBM and Xyquest. IBM commissioned Xyquest to develop a new version of *XyWrite III Plus* that IBM could market as a replacement for the aging *DisplayWrite*. *XyWrite* (still available at \$445) offers high-speed editing, nine file windows, nonstandard keyboard layout, no frills, and a complex programming language that lets advanced users add their own frills. To transform *XyWrite* into an IBM product for a corporate market, Xyquest added a CUA-compliant menu system, mouse support, document summaries, tables, warm links to spreadsheets and word processor files, menu-driven programmable mail-merge, easy keystroke macros, transparent handling of *DisplayWrite* files, and primitive support for imported graphics. It also added zoomable graphics editing using Bitstream Speedo fonts; versions of Times, Helvetica, and Courier ship with the package. Loyal *XyWrite* users may groan under the weight of such a large program, but may be grateful for its new luxuries.

IBM, meanwhile, prepared an often inaccurate manual that emphasized the

SUITABILITY TO TASK				
Signature				
Letter/memo	●	●	●	○
Business report	●	●	○	○
Newsletter	●	●	○	○
Long technical document	●	●	●	○

menus and banished the command line almost entirely to an appendix. But a few days before announcing *Signature*, IBM dissolved the group that planned to market it. The program then returned to Xyquest, which ships it with the IBM-style manual. *XyWrite* upgraders (\$99) also get a thick upgrade manual; *DisplayWrite* upgraders (\$129) get a keyboard template. You can add a \$29.95 command line manual, a \$39.95 technical reference, and a \$29.95 programming guide—all half price through July.

For advanced users, *Signature* retains *XyWrite*'s staggering customization and programmability. You can rewrite the menu and help system, change the symbols on the ruler line, decide which commands produce warning messages, set



Professional Write, Version 2.2

Software Publishing Corp., 3165 Kifer Rd., Santa Clara, CA 95051; 408-986-8000. List Price: \$249.

Requires: 512K RAM, DOS 2.0 or later.

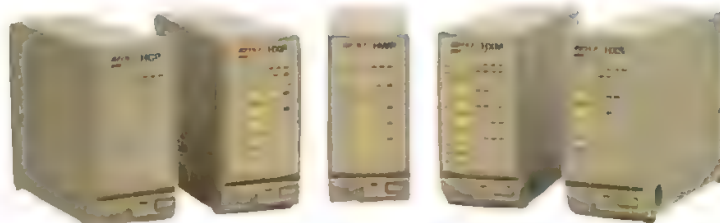
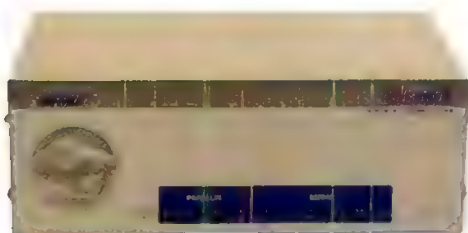
In Short: An improvement over previous releases of *Professional Write*, this version still lacks some key business-oriented features. There is no automatic save function and users can work on only one document at a time. Otherwise, it's an easy-to-master (though not particularly fast) WP package that offers helpful mail-merge and preview features.

CIRCLE 469 ON READER SERVICE CARD

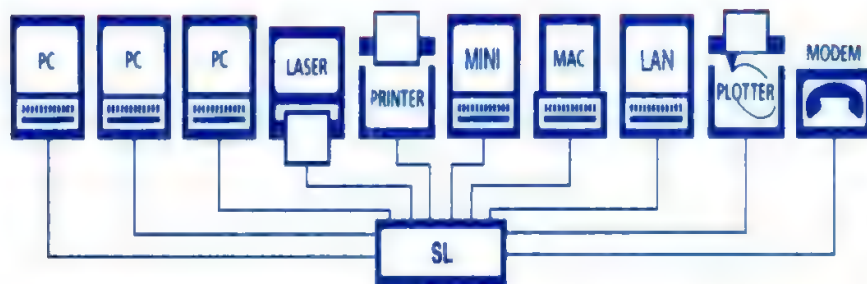
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SLP	8 Par/2 Ser	Any Combination	256KB-4MB	\$495
HXS	4 Serial	Any Combination	256KB-16MB	\$295
HXM	2 Ser/ 2 Par	Any Combination	256KB-16MB	\$295
HWP	5 Parallel	3/2, 4/1	256KB-16MB	\$295
HXP	4 Parallel	2/2, 3/1	256KB-16MB	\$245
HCP	2 Parallel	1/1	256KB-16MB	\$225
AS31	4 Parallel	3/1	None	\$175
AS41	5 Parallel	4/1	None	\$195
AS81S	9 Ser/ 1 Par	8/1	None	\$79

Global computing.



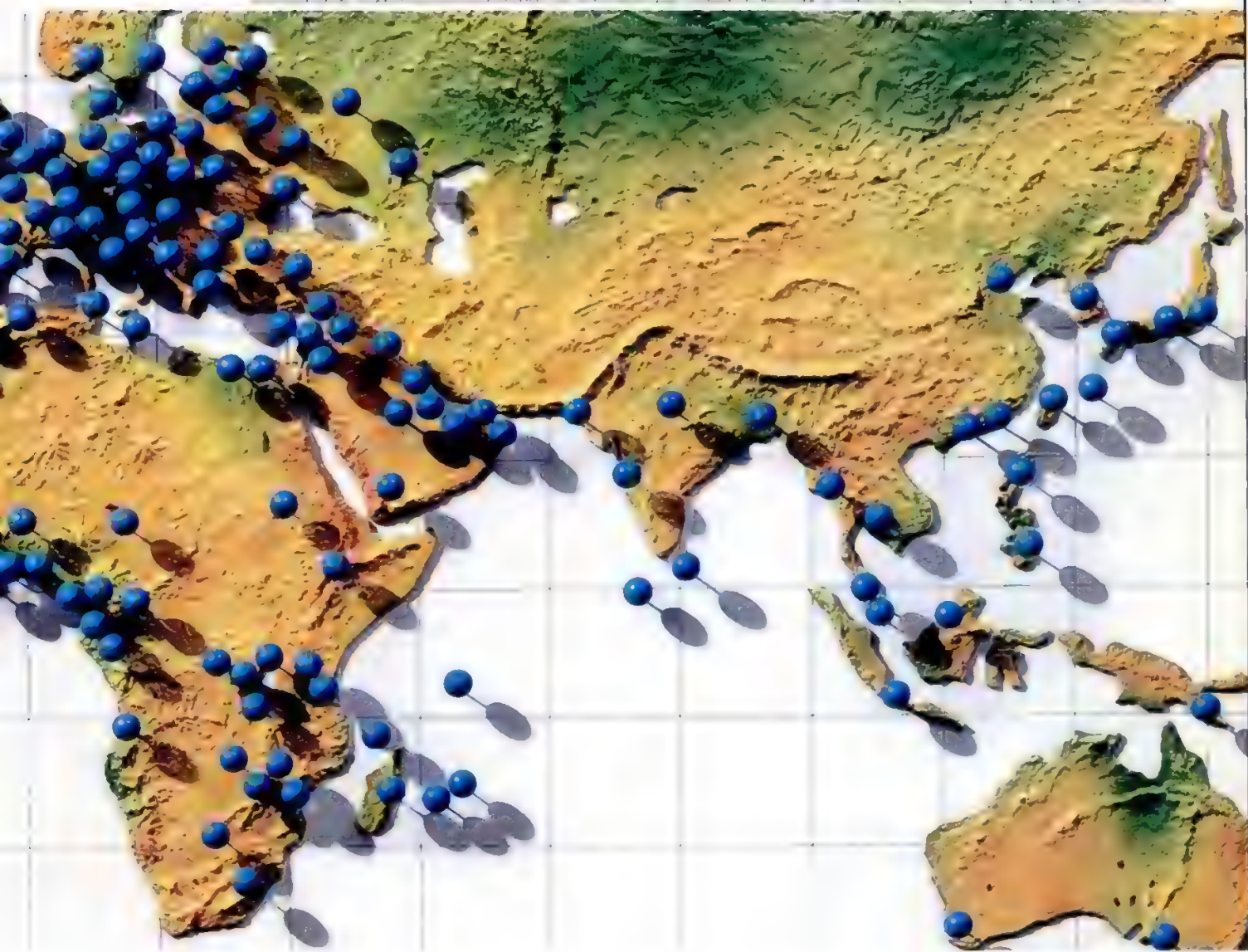
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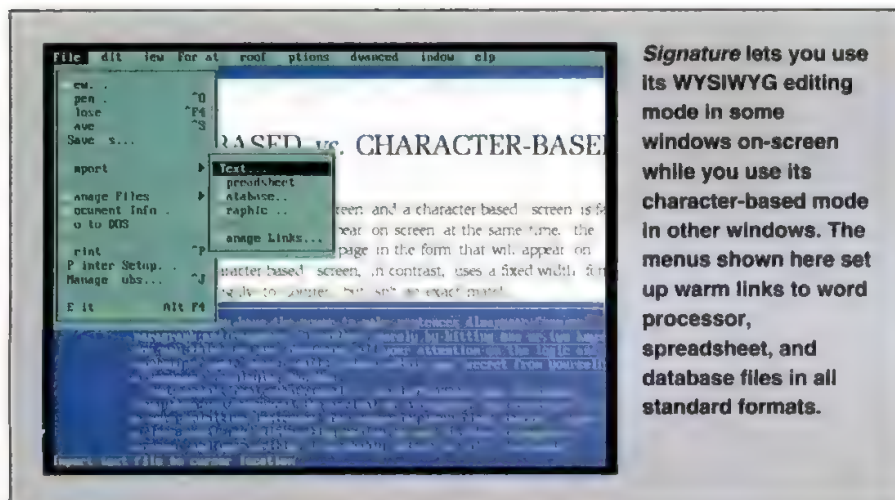
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CIRCLE 066 ON READER SERVICE CARD



Signature lets you use its WYSIWYG editing mode in some windows on-screen while you use its character-based mode in other windows. The menus shown here set up warm links to word processor, spreadsheet, and database files in all standard formats.

the pitch and duration of the keyclick and three different error beeps, and modify almost everything else. You can scroll through and reuse your most recent commands. Search-and-replace supports nine different kinds of wildcards and can search for two strings simultaneously. *Signature* supports IBM's 800-character enhanced symbol set; about 500 characters display in graphics mode and can be printed with the supplied Speedo fonts. *Signature*'s spell-checker is slower than *XyWrite*'s, but it supports IBM's foreign dictionaries.

UPS AND DOWNS

Like *WordPerfect*, *Signature* uses embedded formatting codes, but unlike *WordPerfect*, it doesn't make you insert codes manually before and after text whose format you want to change. Instead, you can specify the format of a defined block, and the program inserts codes to turn on the new format at the start of the block and codes that restore the original format at the end. But *Signature*'s codes can also produce problems. You define a style with one code and invoke it with another; if you delete the definition code, the program beeps at you until you find and delete all instances of the invoking codes.

Signature's exhaustive menu system serves as a sometimes ill-fitting shell over the command line. You can use the menu to set formatting, but you can't use it to modify the codes that the menus insert in the file. These have to be edited directly in the file or in a command window—and the syntax used to edit a code is slightly different from the syntax used to create a code on the command line.

GIVE AND TAKE

The help menu lets you search for a topic by typing its first letter. But if you try to reach topics that begin with S, you stop first at all subheadings beginning with S that are under headings that begin with A through R. You can use a mouse in most menus, but not all; if you use the mouse to define a block, you can't scroll beyond the foot of the screen, and you can't use the mouse to move or resize graphics or windows.

Signature lets you redline on the fly, but you can compare files only by pressing a key that jumps you to the points where they differ. Undelete won't bring back codes or text deleted with the Backspace or Delete key, but the program warns you before removing a code. You can install LaserJet fonts, but not PostScript soft fonts. *Signature* does not offer collapsible outlining.

Version 1.0 offered endnotes on the menu, but you had to keep track of codes



Signature, Version 1.0
Xyquest Inc., 44 Manning Rd., Billerica, MA 01821; 508-671-0888.
List Price: \$495.
Requires: 384K RAM, DOS 3.3 or later.
In Short: *Signature* is the only word processor that offers both text-based and WYSIWYG editing, and it has warm links to word processor and spreadsheet files that you won't find in other DOS packages. Its customization possibilities are unmatched, but the program as a whole awkwardly combines its menu-driven and command line interfaces.

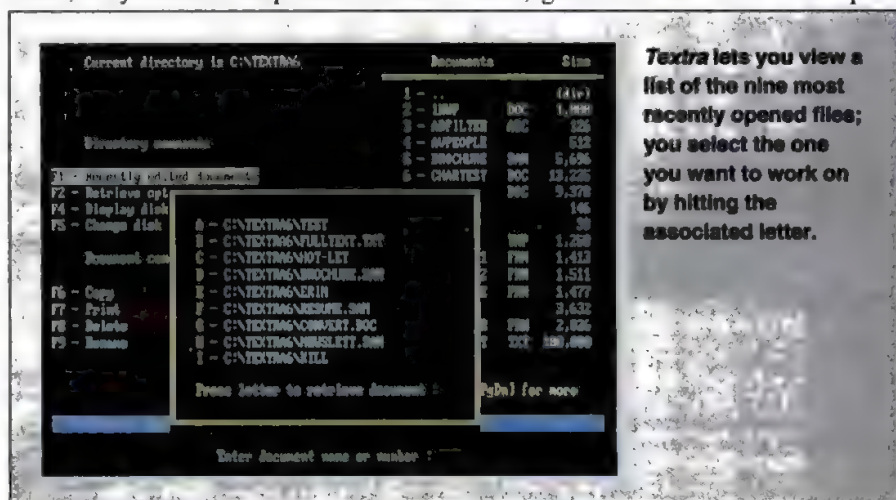
CIRCLE 476 ON READER SERVICE CARD

to make sure they printed at the end. Version 1.02, due by the time you read this, prints endnotes where they belong and adds other minor fixes. *Signature* still looks unfinished, but it's a fast performer with features you can't find in other text-based packages. And when you want the realism of a graphics-based program, *Signature*'s fast WYSIWYG is only a key-stroke away.

Textra

by Lance N. Ulanoff

Like a stealth bomber cruising over the terrain, *Textra* 6.0, from Ann Arbor Software, glides in with a low retail price



Textra lets you view a list of the nine most recently opened files; you select the one you want to work on by hitting the associated letter.



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CIRCLE 107 ON READER SERVICE CARD

SOFTWARE

DOS WORD PROCESSORS

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
☒—Yes ☐—No

	Microsoft Word	Nota Bene	PC-Write Standard Level	Professional Write	Signature	Textra	WordPerfect	WordStar for DOS	Word Writer Pro
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List price	\$450.00	\$449.00	\$129.00	\$249.00	\$495.00	\$95.00	\$495.00	\$495.00	\$99.95
Network version available	☒	☒	☒	☒	☒	☒	☒	☒	☒
Cost per additional user	\$295	\$150	\$69	\$185	\$295	\$95	\$295	N/A	N/A

MEMORY AND DISK USAGE

Uses expanded memory	☒	☒	☒	☒	☒	☒	☒	☒	☒
Disk space used by default installation	2MB	1.5MB	1.6MB	2.4MB	6MB	2MB	5MB	5.5MB	720K

TEXT FORMATTING

Broken underline	☒	☒	☒	☒	☒	☒	☒	☒	☒
Double underline	☒	☒	☒	☒	☒	☒	☒	☒	☒
Strikethrough	☒	☒	☒	☒	☒	☒	☒	☒	☒
Small capitals	☒	☒	☒	☒	☒	☒	☒	☒	☒
Variable page length within document	☒	☒	☒	☒	☒	☒	☒	☒	☒
Vertical centering	☒	☒	☒	☒	☒	☒	☒	☒	☒
Tabs can be entered and changed anywhere	☒	☒	☒	☒	☒	☒	☒	☒	☒
Tabs move when left margin changes	☒	☒	☒	☒	☒	☒	☒	☒	☒
Conditional page breaks	☒	☒	☒	☒	☒	☒	☒	☒	☒
Paragraphs can be linked to remain together on one page	☒	☒	☒	☒	☒	☒	☒	☒	☒
Automatic page numbering after reformatting	☒	☒	☒	☒	☒	☒	☒	☒	☒
Lock indent (left)	☒	☒	☒	☒	☒	☒	☒	☒	☒
Lock indent (left and right)	☒	☒	☒	☒	☒	☒	☒	☒	☒
Decimal line spacing (for example, 1.3 lines)	☒	☒	☒	☒	☒	☒	☒	☒	☒
Spacing adjusts to font height	☒	☒	☒	☒	☒	☒	☒	☒	☒
Variable line spacing within document	☒	☒	☒	☒	☒	☒	☒	☒	☒

TEXT ENTRY AND EDITING

Ruler line can be suppressed	☒	☒	☒	☒	☒	☒	☒	☒	☒
Paragraph-marker option	☒	☒	☒	☒	☒	☒	☒	☒	☒
Format codes can be viewed	☒	☒	☒	☒	☒	☒	☒	☒	☒
One-step deletion of:									
Sentence	☒	☒	☒	☒	☒	☒	☒	☒	☒
Paragraph	☒	☒	☒	☒	☒	☒	☒	☒	☒
Page	☒	☒	☒	☒	☒	☒	☒	☒	☒
Column	☒	☒	☒	☒	☒	☒	☒	☒	☒
Number of undelete levels	1	5	1	1	1	1	3	1	1
One-step blocking of:									
Paragraph	☒	☒	☒	☒	☒	☒	☒	☒	☒
Page	☒	☒	☒	☒	☒	☒	☒	☒	☒
Column	☒	☒	☒	☒	☒	☒	☒	☒	☒
Block can be extended	☒	☒	☒	☒	☒	☒	☒	☒	☒
Automatic reformatting after block move	☒	☒	☒	☒	☒	☒	☒	☒	☒
Copies or moves to another window	☒	☒	☒	☒	☒	☒	☒	☒	☒
Saves reformat parameters to a file	☒	☒	☒	☒	☒	☒	☒	☒	☒
Appends block to an existing file	☒	☒	☒	☒	☒	☒	☒	☒	☒
Search-and-replace:									
Forward and backward	☒	☒	☒	☒	☒	☒	☒	☒	☒
Verifies replace	☒	☒	☒	☒	☒	☒	☒	☒	☒
Searches within other files	☒	☒	☒	☒	☒	☒	☒	☒	☒
Case-sensitive searches	☒	☒	☒	☒	☒	☒	☒	☒	☒
Recognizes whole words	☒	☒	☒	☒	☒	☒	☒	☒	☒
Uses wildcards	☒	☒	☒	☒	☒	☒	☒	☒	☒
Search-and-replace for format codes or settings	☒	☒	☒	☒	☒	☒	☒	☒	☒
Maximum number of on-screen editing windows	9	1	10	1	9	8	2	2	3

N/A—Not applicable: The product does not have this feature.

CONTINUES



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Canon

SOFTWARE

DOS WORD PROCESSORS

SUMMARY OF FEATURES

Products listed in alphabetical order

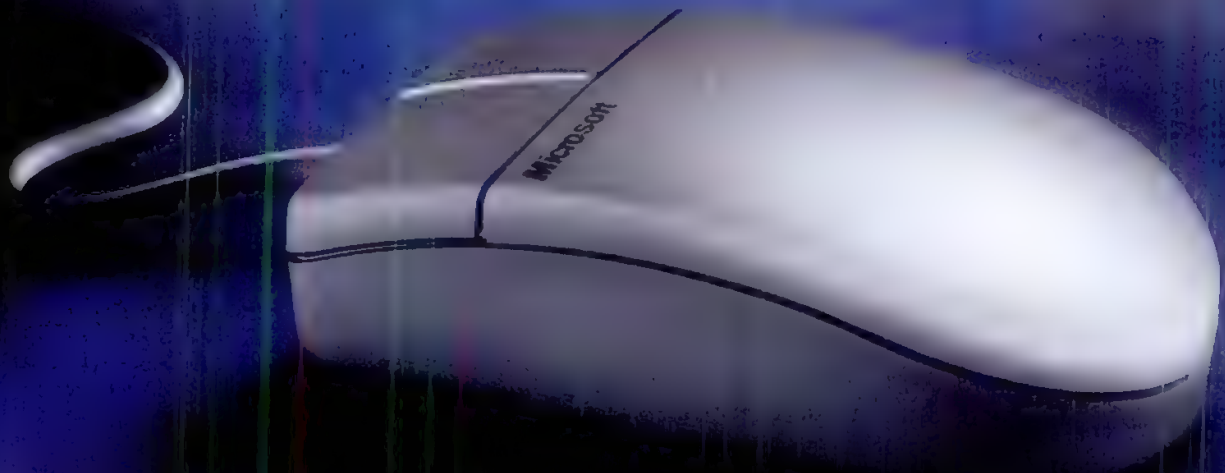


	Microsoft Word	Nota Bene	PC-Write Standard Level	Professional Write	Signature	Textra	PC WordPerfect	WordStar for DOS	Word Writer Pro
PRINTING									
Can modify printer drivers	■	■	■	■	■	■	■	■	■
Background printing	■	■	■	■	■	■	■	■	■
Queues documents for printing	■	■	■	■	■	■	■	■	■
Can change print queue	■	■	N/A	N/A	■	■	■	N/A	■
Prints defined block	■	■	■	■	■	■	■	■	■
Prints continuous range of pages	■	■	■	■	■	■	■	■	■
Prints discontinuous range of pages	■	■	■	■	■	■	■	■	■
Prints current page	■	■	■	■	■	■	■	■	■
Prints high-order ASCII characters	■	■	■	■	■	■	■	■	■
Supports characters not in IBM character set	■	■	■	■	■	■	■	■	■
Automatic envelope formatting and printing	■	■	■	■	■	■	■	■	■
Landscape printing	■	■	■	■	■	■	■	■	■
FILE HANDLING									
Can create simultaneous .BAK files	■	■	■	■	■	■	■	■	■
Performs backup at timed intervals	■	■	■	■	■	■	■	■	■
Includes file-management functions	■	■	■	■	■	■	■	■	■
Searches disk for filenames	■	■	■	■	■	■	■	■	■
Text file import/export:									
Fax format	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
Lotus 1-2-3	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
Microsoft Word	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
MultiMate	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
WordPerfect	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
WordStar	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■
SPELL-CHECKING									
Number of words in standard dictionary	130,000	110,000	50,000	77,000	120,000	80,000	115,000	100,000	100,000
Checks defined block	■	■	■	■	■	■	■	■	■
Check-as-you-type option	■	■	■	■	■	■	■	■	■
Specialized dictionaries available:									
Legal	■	■	■	■	■	■	■	■	■
Medical	■	■	■	■	■	■	■	■	■
Other	■	■	■	■	■	■	■	■	■
HYPHENATION AND THESAURUS									
Inserts soft hyphens automatically	■	■	■	■	■	■	■	■	■
Allows entering soft hyphens from keyboard	■	■	■	■	■	■	■	■	■
Thesaurus provided	■	■	■	■	■	■	■	■	■
Antonyms provided	■	■	■	■	■	■	■	■	■
MANUSCRIPT PREPARATION									
Generates table of contents	■	■	■	■	■	■	■	■	■
Multilevel formats	■	■	N/A	N/A	■	N/A	■	■	N/A
Footnotes and endnotes	■	■	■	■	■	■	■	■	■
Different fonts	■	■	■	N/A	■	■	■	■	■
Auto-numbering	■	■	■	N/A	■	■	■	■	■
Indexing	■	■	■	■	■	■	■	■	■
Multilevel indexing	■	■	N/A	N/A	■	■	■	■	N/A
Cross-referencing	■	■	■	■	■	■	■	■	■
DESKTOP PUBLISHING									
Snaking columns	■	■	■	■	■	■	■	■	■
Single and snaking columns on same page	■	■	N/A	N/A	■	■	■	■	■
Maximum number of columns	22	6	1	1	12	6	24	8	10
Unmatched column widths available	■	■	■	■	■	■	■	■	■
Adjustable gutter width	■	■	■	■	■	■	■	■	■
Restores single columns automatically	■	■	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature.

CONTINUES

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SOFTWARE

DOS WORD PROCESSORS

SUITABILITY TO TASK	
Textra	
Letter/memo	● ● ●
Business report	●
Newsletter	● ●
Long technical document	● ●

(\$95) and modest hardware requirements (384K RAM and 2MB hard disk space), and explodes with unexpected features and power. In *Textra*, budget- and hardware-restricted users (including laptop owners) may find the word processing answer they're looking for.

Once learned, *Textra* can be a powerful and satisfying word processor. In fact, on the merits of its above-average page-layout control, multiple windows, quick recovery of the keyboard after printing, and some nice touches like print preview and a style guide that includes grammar and word usage notes, *Textra* should suit all but the most demanding text-based word processing needs.

Although its Lotus-like menu structure hampers ease of use, and can, initially, make it difficult to learn, *Textra* lets you access nearly all its features through a

series of function-, Alt-, and Ctrl-key combinations. Until you master these, though, you'll often be immersed in layers of submenus. While this provides a clear view of *Textra*'s rich feature set, it also creates a good deal of confusion. An anticipated Version 7.0 should include pull-down menus.

SEE AND DO

The folks at Ann Arbor Software clearly understand that we learn well by watch-

ing. Accordingly, they have provided some ingenious and effective visual training aids: "film-on-disk tutorials" and "How Do I?" references. Using simple animation, these lead you step-by-step through the basic word processing tasks. In the "film-on-disk tutorial," you can adjust the animation playback speed, pause the action, start over, or hit Escape to return to your work at any time. One shortcoming: The menu of film-control choices disappears after the first frame, and you're likely to forget how to control it. *Textra* also includes competent on-line context-sensitive help.

Textra gives you all the features you need for standard business correspondence, including spell-checking, a thesaurus, form-letter templates, and mail-merging. You format documents using either predefined stylesheets or embed-

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
☒—Yes ☐—No

Microsoft Word Not a Bene PC-Write Standard Level Professional Write Signature Textra WordPerfect WordStar for DOS Word Writer Pro

DESKTOP PUBLISHING (continued)

Column width can be defined by moving cursor	☐	☐	☐	☐	☐	☐	☒	☐	☐
Line drawing using cursor	☒	☐	☐	☒	☒	☐	☒	☐	☒
Expandable box around text	☒	☐	☐	☐	☒	☒	☒	☐	☐
Imports graphics	☒	☐	☐	☐	☒	☒	☒	☒	☒
Can resize imported graphics	☒	N/A	N/A	☐	☒	☒	☒	☒	☒
Text flows around graphics	☒	N/A	N/A	☐	☒	☒	☒	☒	☒
Page preview	☒	☐	☒	☒	☒	☒	☒	☒	☒
Full-page vertical monitor supported	☒	☒	☒	☐	☒	☒	☒	☒	☒
Zoom image	☐	☐	☐	☒	☒	☒	☒	☒	☐
Files directly importable by:									
PageMaker	☒	☒	☐	☐	☒	☒	☒	☒	☐
Ventura Publisher	☒	☒	☐	☐	☒	☒	☒	☒	☐

NUMERIC FEATURES

Dynamic table functions	☐	☐	☐	☐	☐	☐	☒	☐	☐
Arithmetic operations within document	☒	☒	☐	☒	☒	☐	☒	☒	☒

CORPORATE AND PROFESSIONAL FEATURES

Conditional mail-merge (for example, if field > 100 print "Thanks")	☒	☐	☐	☐	☒	☒	☒	☒	☒
Mailing labels	☒	☒	☒	☒	☒	☒	☒	☒	☐
Group editing and file comparison:									
Revision marking	☒	☐	☐	☐	☒	☐	☒	☐	☐
Changes verified one by one	☒	☒	☐	☐	☒	☐	☒	☐	☐
File comparison	☒	☒	☐	☐	☒	☐	☒	☐	☐
Outline numbering	☒	☒	☐	☐	☒	☐	☒	☐	☐
Collapsible outlines	☒	☒	☐	☐	☒	☐	☒	☐	☐
Telecommunications module	☐	☐	☐	☐	☐	☐	☒	☐	☐
Passwords	☐	☐	☐	☒	☒	☒	☒	☐	☒
File encryption	☐	☐	☐	☒	☐	☒	☒	☐	☐
Preformatted forms processing	☐	☒	☐	☐	☒	☐	☒	☐	☐

MACROS

Programmable macros (with if-then)	☒	☒	☐	☐	☒	☐	☒	☒	☒
Keyboard recording mode	☒	☐	☒	☒	☒	☒	☒	☒	☒

HELP AND DOCUMENTATION

Context-sensitive on-line help	☒	☒	☒	☒	☒	☒	☒	☒	☒
Adjustable help levels	☐	☐	☐	☐	☐	☐	☒	☒	☒
Keyboard templates	☒	☒	☐	☐	☒	☒	☒	☐	☒
Tutorial	☒	☒	☒	☒	☒	☒	☒	☐	☐

N/A—Not applicable: The product does not have this feature.

ENDS

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ded codes. Each stylesheet, which you can name and save separately from documents, can contain up to seven separate paragraph formats, each of which, in turn, can specify numerous parameters of style and layout.

Merge printing is facilitated by *Textra*'s address book feature, an easy-to-use database for which you can design your own data entry forms. When you've finished creating your document and saved it, *Textra* lets you hotlink it to the address book. When you open the document file, the address book pops up automatically, prompting you to choose an addressee, which it promptly merges into the document for printing.

PLENTY OF TALENT

Textra's multicolumn abilities rival those of many of the more expensive word processing software packages we tested. You can design pages with as many as six variable-width columns. *Textra* also offers widow control, page-break control, and anchored graphics. Speaking of graphics, not only can *Textra* import EPS (PostScript), TIFF, and .PCX files, it can resize, distort, and shade them. Also admirable are *Textra*'s flexible, easy-to-use macros for printing labels and envelopes.

On our performance tests—which included program loading, file loading, scrolling, search-and-replace, and printing—*Textra* typically came in among the top three. The package defaults to back-

While these character-based word processors are faster than the Windows word processors we tested for our cover story of February 25, 1992, they are not dramatically faster.

WHAT THE NUMBERS MEAN

While speed isn't everything in a character-based word processor, it is nonetheless important. PC Magazine Labs' tests indicate that some of these word processors are fast by any standard, but by no means are they all speed burners. Choose carefully.

On the Document Load tests all of the programs performed fairly well, with the exception of *Professional Write*. The Global Search-and-Replace test yielded similar results.

The Top-to-Bottom Scroll test yielded clear winners and losers. *WordPerfect* and *Microsoft Word* outperformed the rest of the pack. *Textra*, *Word Writer Pro*, and *Signature* formed a second tier, while the rest were just outclassed.

There were also some clear winners on the Print tests. *WordStar* for DOS, *WordPerfect*, *Textra*, *Nota Bene*, and *Signature* all performed well. The rest failed to distinguish themselves.

ground printing, queuing up print jobs to allow you to continue working. In addition, you can easily change the print order or remove individual print jobs from the queue.

Textra provides drivers for some 300 printers, of which you can elect to install as many as four. In addition to supporting a number of font and PostScript cartridges, *Textra* provides accurate screen fonts for all supported printers.

Some of *Textra*'s features are quite advanced and typical of word processing software packages that cost four times as much. Examples are the pick list of the

HOW WE TESTED

PC Magazine Labs ran its word processing performance tests on a Compaq Deskpro 386/25M with 8MB RAM and a 300MB hard disk, running Compaq DOS 5.0. For the printer tests, the computer was connected to an HP LaserJet III printer.

Our test document was a 100K text file consisting of 16 paragraphs. We ran each test three times, clocked the tests with a stopwatch, averaged the results, and rounded the scores to the nearest tenth of a second.

The **Text Document Load** test measures the time required to bring in our 100K test file from the hard disk and have the word processing software load it into editing mode.

The **Document Load from DOS** test measures the time required to load both the word processor and our 100K test file from the DOS command line.

The **Global Search-and-Replace** test performs an automatic search-and-replace to locate 100 occurrences of a word in the test document and replace each occurrence with another word. Timing begins on execution of the search and ends with the last replacement.

The **Top-to-Bottom Scroll** test times a scroll through the entire document from top to bottom. The scroll command is issued by placing the cursor on the top line of the document and pressing and holding the Down Arrow key. Timing starts when the arrow is pressed and stops when the cursor reaches the end of the file.

The **Regain Keyboard Control After Print Command** test has two versions. First, for the **Fixed Font** test, we format the document entirely in the Courier font. We then print the file, tracking the time from the keystroke that executes the print command to the moment when control of the keyboard is regained. Then, to test **Proportional Font** performance, we reformat the document using the CG Times font and repeat the test.



FACT FILE

Textra, Version 6.0
Ann Arbor Software, 345 S. Division St., Ann Arbor, MI 48104; 313-768-9088.

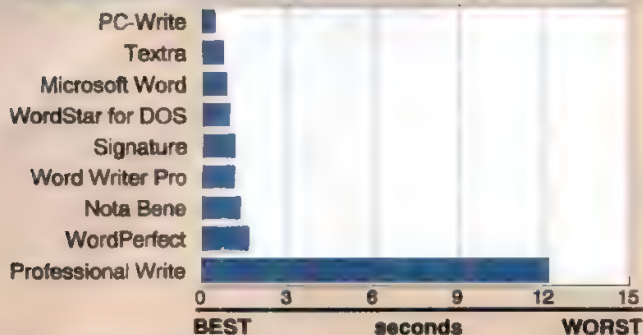
List Price: \$95.

Requires: 384K RAM, DOS 2.0 or later.

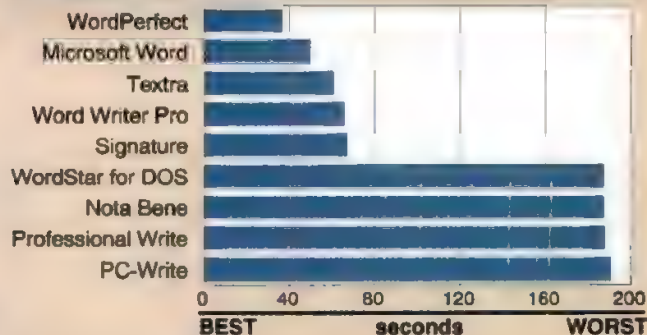
In Short: *Textra* offers a full cadre of editing functions, and an above-average level of page design control. Menu control can be difficult at times, but *Textra* is ultimately worth the price of admission. Its speed rivals that of many GUI word processors, and *Textra* handily imports most other DOS-based word processing files and a full complement of graphics images.

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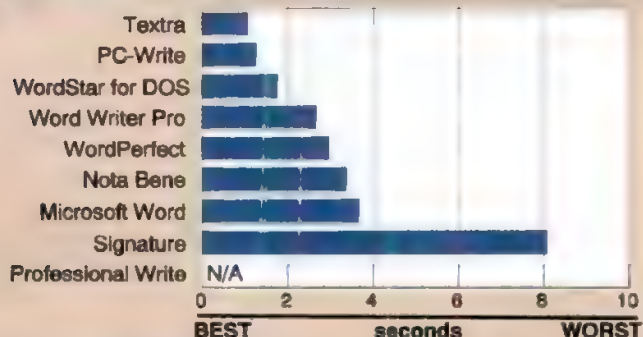
TEXT DOCUMENT LOAD



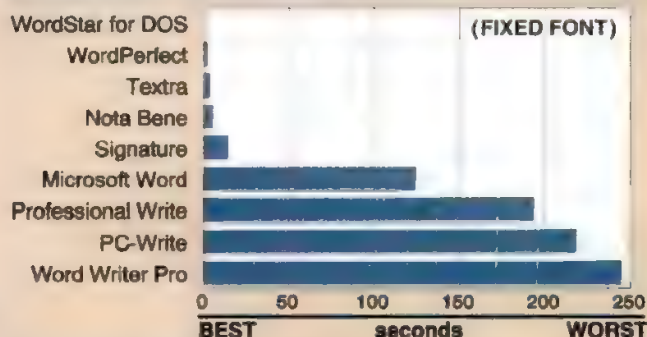
TOP-TO-BOTTOM SCROLL



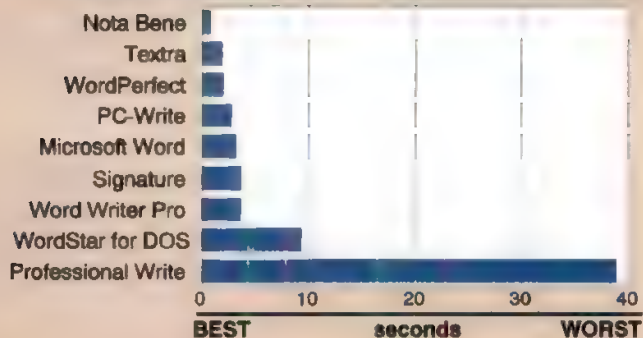
DOCUMENT LOAD FROM DOS



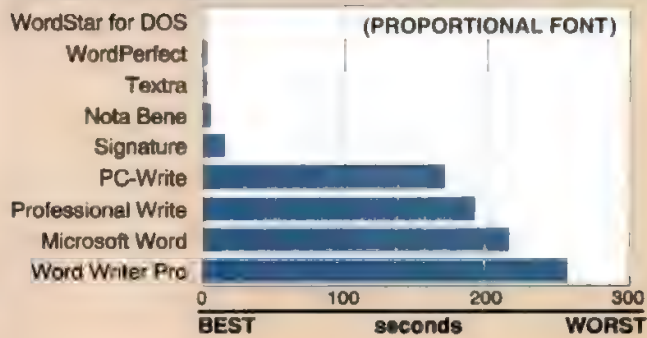
REGAIN KEYBOARD CONTROL AFTER PRINT COMMAND (FIXED FONT)



GLOBAL SEARCH-AND-REPLACE



REGAIN KEYBOARD CONTROL AFTER PRINT COMMAND (PROPORTIONAL FONT)



N/A—Not applicable: This product could not complete the test.

would appear to have just one choice: "... hit F10 for a more complete search." *Textra* fails to prompt you to tap Escape, which brings up the menu with the rest of the main spell-checking choices: Suggest corrections, Accept to a temporary dictionary, Ignore the word, or Manually correct it. These choices belong in the first menu. Hyphenation is another disappointment. *Textra*'s weak manual hyphenation occasionally fails to recognize common words (*enquiry* tripped it up, for example), and sometimes breaks words incorrectly.

On balance, in the realm of text-based

word processors, these shortcomings don't cast a terribly dark shadow on *Textra* 6.0. With its enticingly low price, *Textra* may well be the leanest, meanest word processing package out there.

WordPerfect

by Edward Mendelson

WordPerfect 5.1 so thoroughly dominates the character-based word processing market that it's easy to forget that WordPerfect Corp.'s \$495 colossus faces

any competition at all. Virtually anything you want to do with a word processor—and much of what you want to do in a desktop publishing program—can be done in *WordPerfect*, generally with a few keystrokes, and often with more conveniences than you can find anywhere else.

When you need to do something complicated like install new printer fonts or use different page sizes and orientations in the same file, *WordPerfect* usually makes the job blissfully easy. Its unique balance of simplicity and power and its advanced document management make it the obvious choice for offices that need to

SOFTWARE

DOS WORD PROCESSORS

use the same package for memos and for multichapter, multicolumn books that include cross-references, graphics, and links to spreadsheets—all visible in a fast preview mode.

WordPerfect is also the one word processor that shares its files transparently with versions for Microsoft Windows and

SUITABILITY TO TASK				
WordPerfect				
Letter/memo	●	●	●	●
Business report	●	●	●	●
Newsletter	●	●	●	●
Long technical document	●	●	●	●

most other platforms, as well as with its smaller laptop-ready DOS sibling, the \$199 *LetterPerfect*. And if there's anything you can't do in *WordPerfect* alone, you can probably do it with one of dozens of third-party add-ons that make *WordPerfect* seem like the capital of a vast software empire. You can integrate *WordPerfect* with other applications through the \$149 *WordPerfect Office*, which lets you create in a DOS or DOS-based LAN context a fast task-switching environment with much of Windows' flexibility.

HUMBLE BEGINNINGS

WordPerfect features like a margin-release key make clear that the program originated in the early 1980s as a replacement for the typewriter, and it still shines at the straightforward tasks of editing and printing text. A three-level undelete function intelligently recognizes as a single deletion ten words that you delete in sequence. *WordPerfect* includes advanced formatting features like true parallel columns (as distinct from text tables), easily produced complex tables, text printed at a

precise distance from other text, imported bitmap and vector graphics, and subtle control over kerning, letter spacing, and word spacing.

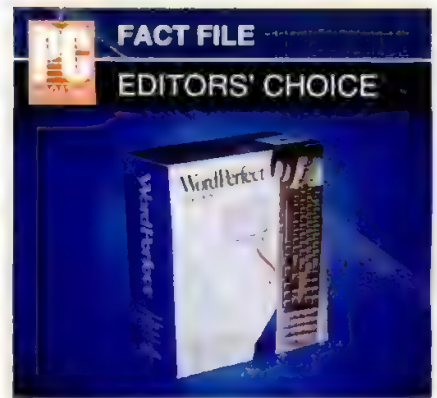
WordPerfect's code-based file structure gives you precise but sometimes awkward control over formatting. You generally can't "paint" a block of text and apply formatting to the block alone. You can search for codes only in a general way; for example, you can search for a specific margin-change code, but not for all codes that set the margin to 2 inches. You have to use an awkward-looking reveal-codes screen to sort out format problems.

SORT AND PRINT SUPPORT

WordPerfect lets you sort text on multiple fields, program complex macros and merges, format legal documents automatically, and customize the spelling dictionary. But you don't get collapsible outlining, you can open and edit only two files at once, and styles tend to be too awkward to handle anything more complex than font changes or numbering formats. You can compare two versions of a file, but you can't redline while revising. A supplied macro prints envelopes reliably.

The hard-to-memorize function-key layout makes more sense if you have function keys on the left instead of the top. But you can remap key assignments, and an optional on-screen menu is an alternative route to the well-organized submenus that you reach with function keys.

WordPerfect's astonishing printer support exploits the most arcane features of almost a thousand different models—and at greater speeds than any other word



WordPerfect, Version 5.1

WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; 800-451-5151, 801-225-5000.

List Price: \$495.

Requires: 384K RAM, DOS 2.0 or later.

In Short: *WordPerfect 5.1*, a text-based powerhouse, deserves its rank as the undisputed market leader. Its sometimes awkward keyboard is balanced by the depth of its features and by the conveniences built into its most advanced functions. It can handle desktop publishing tasks with much of the aplomb of Windows packages.

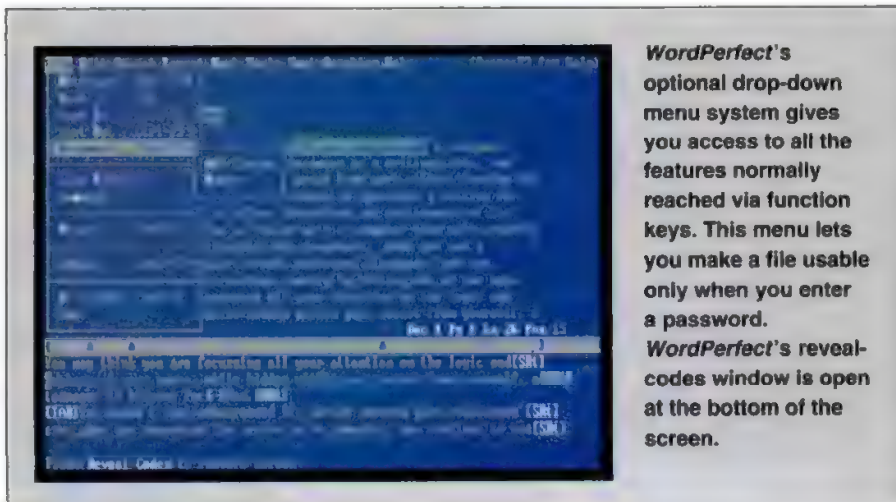
CIRCLE 472 ON READER SERVICE CARD

processor. You can print more than 1,500 characters, and if a character isn't in your fonts, *WordPerfect* draws it as a graphic. A unique printer-definition program lets you fine-tune printer drivers; you can even adjust the underline position.

With its extraordinary depth of features and its legendary toll-free support, *WordPerfect* triumphs over its minor awkwardnesses and limitations. Other text-based programs surpass individual parts of it, but for overall power and flexibility, nothing surpasses *WordPerfect* as a brilliantly integrated whole.

WordStar for DOS

by Bruce Brown



WordPerfect's optional drop-down menu system gives you access to all the features normally reached via function keys. This menu lets you make a file usable only when you enter a password.

WordPerfect's reveal-codes window is open at the bottom of the screen.

WordStar lovers take heed. With its new streamlined, SAA/CUA-compliant, mouse- or keyboard-driven user interface and numerous other enhancements, *WordStar for DOS*, Version 7.0 (\$495), is significantly upgraded from earlier editions. There are plenty of good reasons for established *WordStar* users to upgrade to 7.0, and the modest \$89 upgrade cost should make it economically painless. Users of competing programs can switch to *WordStar* for the same upgrade fee (through June). *WordStar International* clearly hopes that this great deal will

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- Windows 3.0
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- Mid-tower case with 6 drive bays
- 200 Watt power supply
- Real time clock/ calendar w/ battery backup
- 101-key enhanced keyboard



SOFTWARE

DOS WORD PROCESSORS

draw many of the former faithful back to the fold.

Beyond the updated interface, new enhancements include an editable macro facility with keystroke recorder and macro command language, fax support, significantly improved graphics import capability, and Windows 3.x Clipboard support.

LOOKING BACK

WordStar, of course, originated as a command-driven program, and this has been both its strength and its weakness: While no one disputed *WordStar*'s prowess as an editor, many found it difficult to learn. To address this issue, the vendor added menus to Version 5.0 of the product. Version 7.0's newly redesigned menus are a big improvement, and, along with mouse support and pop-up dialog boxes, make the package much smoother and easier to work with. For old-time *WordStar* hands who still swear by Ctrl-key-stroke combinations and dot commands, the good news is that the commands they know and love still work.

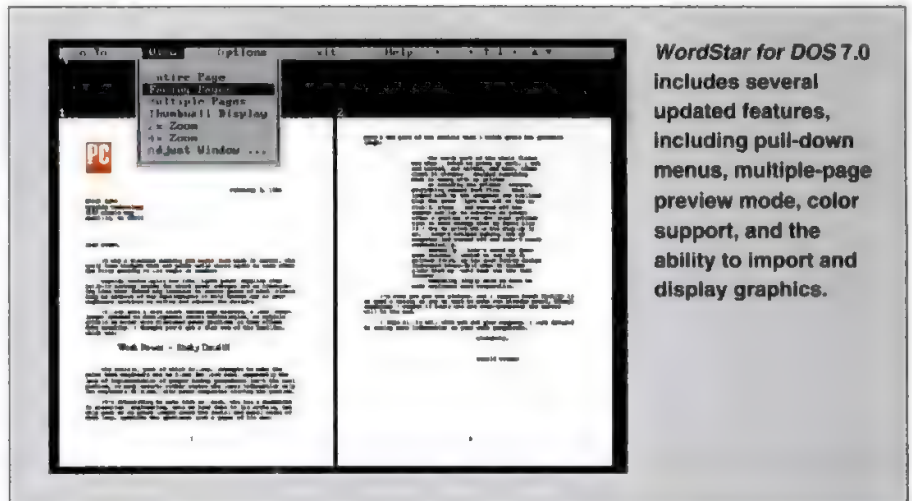
Mail-merge capabilities, a longtime strength of *WordStar*, remain as awesome as ever. And the same can be said of

WordStar's page preview mode. Not only can you see the current page with columns, headers, footers, and graphics, you can view another page, go to any page you specify, zoom in or out, and view thumbnails of the whole document. In fact, *WordStar*'s page preview outperforms that of any other word processor.

WordStar uses stylesheets called para-

graph styles, which can include settings for fonts, leading, tabs, margins, indents, text alignment, character enhancements (bold, italic, and underlining), and text and background colors. While any of these attributes can be set with individual embedded codes (dot commands), it's fairly easy to control the paragraph stylesheet's many settings at once via a full-screen definition dialog box.

WordStar supports multiple columns



WordStar for DOS 7.0 includes several updated features, including pull-down menus, multiple-page preview mode, color support, and the ability to import and display graphics.

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Fiction

Fact

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by Gary Lancaster

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CIRCLE 136 ON READER SERVICE CARD

SOFTWARE

DOS WORD PROCESSORS

in either snaking or parallel mode. Column settings (width and number) are easily made or changed using either the special dialog box or user-inserted dot commands. If you're looking for direct, interactive manipulation of column widths or other document features with either mouse or cursor, however, you'll have to look elsewhere. The actual column layout can be viewed only in page preview mode.

Previous versions of *WordStar* sup-

ported the importation of .PCX-format graphics files only. *WordStar* 7.0, however, can import 27 graphics file formats, and graphics can be placed anywhere in a document. As with columns, you must switch to page preview mode to view graphics objects. Once in preview, you can define colors and shading to a limited degree. Using the included TSR utility,

INSET, you can capture, display, edit, and print graphics from other programs for use in *WordStar* documents.

ALSO STARRING

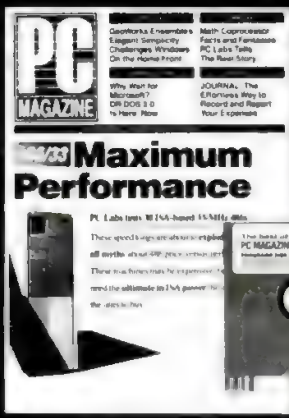
WordStar's new fax capabilities consist of a convenient utility that converts whole documents or a specified range of pages into .PCX files. *WordStar* doesn't include fax software itself, but most, if not all, fax modem software can handle .PCX files.

WordStar for DOS 7.0 isn't a Windows application, of course, but it is somewhat Windows-aware. If you run *WordStar* 7.0 from within Windows 3.x, you can easily copy blocks of ASCII text to and from the Windows Clipboard.

WordStar for DOS 7.0 comes with supplementary programs to perform tasks such as telecommunicating directly from the word processor's main menu; building user menus; working with merge-list files; converting word processing, spreadsheet, and database format files; and file management. Using these modules from within *WordStar* suspends the word processor. So while these add-ons do add value, their lack of integration with the word processor may dull their appeal.

Speed test results were mixed for *WordStar* 7.0. Whereas the program itself loaded relatively slowly, document-file loading was fairly speedy. The document scrolling and search-and-replace test times were both on the slow side. Due to its back-

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WordStar for DOS, Version 7.0

WordStar International Inc., 201 Alameda del Prado, Novato, CA 94949; 800-227-5609, 415-382-8000.

List Price: \$495.

Requires: 512K RAM (640K for page preview), DOS 2.11 or later; Hayes or Hayes-compatible modem required for telecommunications module.

In Short: The newest *WordStar* version has a more up-to-date interface, a macro language with learn mode, fax software support, and many other less important functional enhancements. Accompanied by an assortment of accessory programs, Version 7.0 is an incremental upgrade for loyal *WordStar* users that has little to attract satisfied users of other word processing programs.

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CODE A4010

SOFTWARE

DOS WORD PROCESSORS

SUITABILITY TO TASK				
WordStar for DOS				
Letter/memo	●	●	●	●
Business report	●	○	○	○
Newsletter	●	○	○	○
Long technical document	●	○	○	○

ground printing capability, however, *WordStar* returns keyboard control to you very quickly (in less than a second), allowing you to continue your work. Printing isn't speeded up, but the keyboard control issue is usually more important.

WordStar for DOS 7.0 is a full-featured text-based word processor with unusually powerful mail-merge capability and the best print preview in the character-based world. For all the new features, *WordStar* still lacks at least some of the high-end capabilities found in *WordPerfect* and *Microsoft Word*—conveniences like collapsible outlining, for example—but then it has some—like fax and telecommunications—that those packages lack. The patchwork of add-on utilities and supplemental programs give *WordStar* a somewhat disjointed feel, but at least it's moving forward.

Word Writer Pro

by John R. Quain

With *Word Writer Pro 1.1* from Timeworks, individual and small-business users won't waste time searching for function keys or wondering if there's a training course they should attend. Of course, with a list price of \$99.95, users should also expect some limitations.

Word Writer Pro (WWP) comes bundled with Timeworks' low-cost desktop publishing program *Publish It Lite!*, and contains all the features necessary for creating form letters and standard documents, but it does not include facilities for heavy manuscript work or complex corporate business reports. A significant weakness is its inability to import or export any file formats other than its own proprietary one and ASCII (*Publish It Lite!* handles only .PCX and .IMG formats). But for individual users short on patience (and hard disk space), *WWP* proves quite versatile.

Up and running within 15 minutes, *WWP*'s attractive interface mimics that of sophisticated graphical word processors. Like packages twice its size and price,

WWP allows you to work on as many as three windowed documents simultaneously. A bar along the top of the screen lists pull-down menu selections, and a status line runs along the bottom of the screen. Hitting Esc calls up the menus.

EDITING EASE

Editing operations are easy to master using a cut-and-paste approach to changing and moving highlighted blocks of text. If you prefer point-and-click editing, the program also supports a two-button mouse. For fast learners, the package uses Alt- and Ctrl-key combinations to circumvent the menus. Documents can be saved automatically (at intervals of between 1 and 59 minutes) using a handy backup option.

WWP includes a 100,000-word spell-checker, a thesaurus, and a proofreading utility. The spell-checker can perform a continuous check on your work or—if you find that too distracting—check an entire document, block of text, or a single word. The checker includes a phonetic parameter so that when misspelled words are detected, the program looks for the closest sounding correction. Is your prose too prolix for your peers? A handy "fog index" option with sentence-length management and a personal dictionary will help keep things under control.

And *WWP* is quick. On PC Magazine Labs' benchmark tests, *WWP* never led the group, but it kept pace with the faster packages. In Document Load tests, it was one of the speedier programs. Moreover, search-and-replace test times were certainly quick enough, and printing times ranged from fair to average.

WWP supports most popular dot matrix and laser printers—46 in all—though not PostScript. Hewlett-Packard font cartridges are supported, however. And the program offers one major printing convenience: buffer control. With a pull-down menu, users can adjust print buffers (from 0 to 64K), and enable background printing for small documents.

TOUGHER TASKS

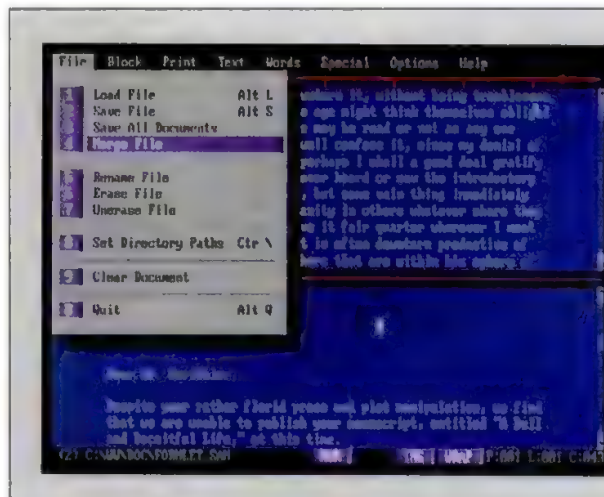
Though sophisticated desktop publishing and manuscript abilities are absent, *WWP* does have the skills necessary to record conditional macros, create footnotes and endnotes, and make simple line drawings. A form-letter facility performs mail-merges easily. However, you are limited to a maximum of 200 addressees, and your form letter cannot exceed four pages.

More experienced users will appreciate *WWP*'s macro recording and editing feature. There are no preset macros, but recording and editing user-defined macros

SUITABILITY TO TASK				
Word Writer Pro				
Letter/memo	●	●	●	●
Business report	●	○	○	○
Newsletter	●	○	○	○
Long technical document	●	○	○	○

is a simple task. The recording mode tracks your actions and, once saved, the macro can be loaded or edited at any time.

Footnotes and endnotes are easy to manage, and they come with automatic renumbering and font and placement options. Still, *WWP* lacks table of contents and indexing functions. So, while *WWP* is skilled enough to create a school paper or an academic monograph, it's not talented



Word Writer Pro's drop-down menus provide easy access to all of the program's features, including the ability to work on as many as three documents simultaneously.

SOFTWARE DOS WORD PROCESSORS



Word Writer Pro, Version 1.1
Timeworks Inc., 625 Academy Dr.,
Northbrook, IL 60062; 800-323-7744, 708-559-
1300

List Price: \$99.95 (includes *Publish It Lite!*).
Requires: 512K RAM, DOS 2.1 or later.
Mouse recommended for use with *Publish It Lite!*

In Short: For the money—and most people's limited time—*Word Writer Pro* offers a lot. The \$99.95 package includes a spell-checker, thesaurus, proofreading utility, footnotes/endnotes, mouse support, multiple windows, and *Publish It Lite!* However, the program does not have features for serious manuscript and desktop publishing work, and can import only ASCII files.

CIRCLE 474 ON READER SERVICE CARD

screen reference for function keys and context-sensitive help are both available. When things go awry, most errors are explained, and a prompt tells you how to proceed correctly.

An automatic program guides beginners through the installation process. WWP requires four 5.25-inch disks (or about 721K of hard disk space), DOS 2.1 or later, and only 512K of memory. So even the XT's in the office can use it.

The WWP package includes a scaled-down version of Timeworks' \$150 *Publish It!* desktop publishing program. Dubbed *Publish It Lite!*, the smaller version includes the GEM/3 environment (without the desktop). *Publish It Lite!* is easy to manage, but it handles only .PCX, .IMG, and .WWP files, and can create documents of no more than four pages. This relegates the package to brochure

and small newsletter publishing. *Publish It Lite!* occupies over 1MB of hard disk space and prints only to an Epson-compatible dot matrix printer.

Word Writer Pro is essentially an upgrade of Timeworks' four-year-old *Word Writer PC*. At \$40, WW PC is half the price of the *Pro* version, but it has only

half the features. *Word Writer Pro* is a reliable, well-conceived program that's easy to follow and performs quickly. Individual users with simple writing needs will be pleased with the package. Corporate

users, however, will doubtless be stymied by *Word Writer Pro*'s lack of file conversions for integrating work from other packages, especially *Lotus 1-2-3*. ■

Lance N. Ulanoff is a staff editor of PC Magazine. Bruce Brown and Edward Mendelson are contributing editors to PC Magazine. John R. Quain is a frequent contributor to PC Magazine.

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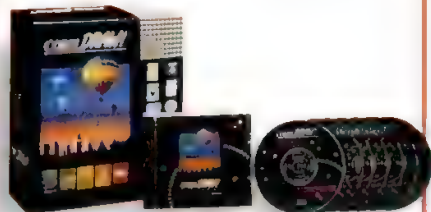
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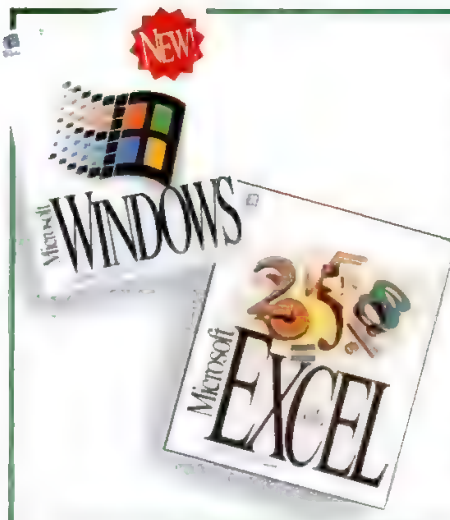
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9832	□ SpinRite II 2.0	64.
Hayes ... NCP		
7983	□ Smartcom EXEC 2.1	75.
Helix Software ... NCP		
9627	□ Netroom 2.1 (single user)	65.
IBM ... NCP		
2666	□ DOS 5.0 Upgrade	59.
ICOM Simulations ... NCP		
1326	□ Intermission 2.0 for Windows	29
Individual Software ... NCP		
6222	□ Resume Maker 1.3	29.
Inset Systems ... NCP		
3020	• HiJaak 1.0 for Windows—Enhances & prints graphics images. Converts 23 raster, 15 vector, & 24 fax card formats. Captures graphics screens from Windows and graphics & text screens from DOS applications .	\$125.



we opened our doors.



ButtonWare ... NCP

6419 ☐ PC-File v. 5—New! Has a Graphical User Interface! Analyze and manage data with relational retrieve, relational posting, search/query. Also available is the PC-File Application Pack - includes six pre-designed applications! ... \$85.

Inset Systems ... NCP

7298	☐ HiJaak 2.1	125.
3820	☐ HiJaak 1.0 for Windows	125.
7300	☐ Inset Plus HiJaak	145.
2040	☐ HiJaak Color Sep 1.0	339.

Intuit ... NCP

2426	☐ Quicken 5.0	45.
5596	☐ Quicken 1.0 for Windows	45.
2474	☐ Quicken with QuickPay	75.

LaserTools ... NCP

6882	☐ PrintCache 2.5	99.
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Lotus ... NCP

5417	☐ 1-2-3 3.1 Plus	415.
5653	☐ 1-2-3 2.3	335.
1852	☐ 1-2-3 2.3 Upgrade	95.
2755	☐ 1-2-3 1.0 for Windows	399.
2747	☐ 1-2-3 for Windows & Ami Pro 2.0 Upgrd	199.
5799	☐ Ami Pro 2.0	299.
1847	☐ Ami Pro Competitive Upgrade	95.
3523	☐ Freelance 1.0 for Windows	349.
2750	☐ cc:mail DOS Platform Pack	129.
2748	☐ cc:mail Windows Platform Pack	335.
2749	☐ cc:mail 25 user Pack	399.

M-USA Business Systems ... NCP

3408	☐ Pacioli 2000 2.0 (Accounting software)	32.
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MECA ... NCP

2798	☐ Managing Your Money 8.0	\$109.
4603	☐ Tobias' Tax Cut 1040 1991	39.

Microcom ... NCP

4408	☐ Micro Courier 1.0	59.
6234	☐ CarbonCopy Plus 6.0	119.
4410	☐ CarbonCopy Plus for Windows	119.

Micrografix ... NCP

3627	☐ Windows Draw! 3.0	99.
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Micro Logic Software ... NCP

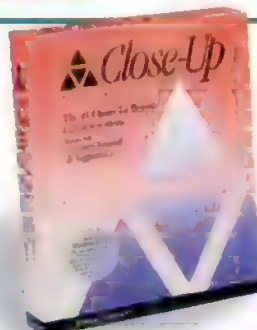
8579	☐ MoreFonts 3.0	75.
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Microlytics ... NCP

7931	☐ Random House Encyclopedia 1.0	68.
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Microsoft ... NCP

3338	☐ Money 1.0 for Windows	45.
7010	☐ Windows 3.1	95.
7388	☐ Project 3.0 for Windows	445.
2904	☐ Works 2.0	95.
2735	☐ Works 1.0 for Windows	129.
3337	☐ Publisher 1.0 for Windows	129.
7387	☐ PowerPoint 2.0 for Windows	309.
6195	☐ Word 2.0 for Windows	309.
2856	☐ Excel 4.0 for Windows	309.
8137	☐ Office 2.0 for Windows	479.
1620	☐ MS-DOS 5 Upgrade	49.
1624	☐ Visual Basic 1.0	129.



Norton-Lambert ... NCP

2753 ☐ Close-Up
... PC Magazine's Editors' Choice (2/92). New remote Close-Up lets you take control of PC's miles away by modem. PC World's "Best Buy" (2/92) ... intro. price until 6/30/92 \$129.

Multisoft ... NCP

4925	☐ PC-Kwik Power Pak 2.1	79.
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Niles & Associates ... NCP

3868	☐ EndNote 1.0	89.
3880	☐ EndNote Plus 1.0	149.

Nolo Press ... NCP

5122	☐ For The Record 2.0	35.
2982	☐ WillMaker 4.0	39.

Norton-Lambert ... NCP

2753	☐ Close-Up for Windows & DOS Dual Pack	129.
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Novell ... NCP

4000	☐ Netware Life 1.0	69.
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Okma ... NCP

9696	☐ Desktop Set 4.0 for Windows	79.
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Paradea ... NCP

2413	☐ WinSpeed 1.0 (Windows accelerator)	55.
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Adobe Systems ... NCP

Includes
Adobe Type Manager, TypeAlign, Separator,
40 Adobe typefaces & a selection from the
Adobe Collector's Editions. Comes with FREE
Adobe Streamline 3.0 for the first 90 days ... \$429.

PC Globe ... NCP

5902	☐ PC Globe 4.0	39.
5900	☐ PC USA 2.0	32.

Personics ... NCP

9288	☐ Laptop Ultravision 2.1 (3 1/2" only)	45.
4384	☐ Ultravision 2.0	79.

Polaris Software ... NCP

4395	☐ PackRat 4.0	249.
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PowerUp! ... NCP

7860	☐ Calendar Creator Plus 4.0	52.
7857	☐ Labels Unlimited 3.0	59.
7858	☐ Express Publisher 2.0	99.

Qualitas ... NCP

7539	☐ 386MAX 6.0	59.
7967	☐ BlueMAX 6.0 for PS/2 (3 1/2" only)	79.

Quarterdeck ... NCP

3221	☐ Expanded Memory Mgr 386 6.0	59.
4586	☐ DESQView 386 2.4	129.

QUE Software ... NCP

4155	☐ RightWriter 5.0	54.
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Reality Technologies ... NCP

7891	☐ WealthStarter 2.0 w/Charles J. Givens	35.
6572	☐ WealthBuilder 1.1	95.

Reference Software ... NCP

4396	☐ Grammatik V 1.0	59.
7483	☐ Grammatik Windows 1.0	59.
3821	☐ Webster's Electronic Dictionary & Thesaurus	59.

Roykore ... NCP

2473	☐ Instant ORG Charting! 1.0	125.
8162	☐ ABC Flowchart 1.1	189.

Sitka ... NCP

6675	☐ TOPS Network Bundle 3.0	159.
3720	☐ Flash Card (hardware)	155.

Software Marketing Corp. ... NCP

5145	☐ Bodyworks 1.0	45.
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Software Publishing ... NCP

3482	☐ Harvard Graphics 3.0	399.
4403	☐ Harvard Graphics 1.0 for Windows	399.

Software Ventures ... NCP

6889	☐ MicroPhone II 2.0 for Windows	99.
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Spinnaker ... NCP

1415	☐ PFS WindowWorks 1.0	129.
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Stac Electronics ... NCP

1409	☐ Stacker 2.0	85.
3524	☐ Stacker 2.0 w/16-bit Coprocessor Card	185.

Symantec ... NCP

3784	☐ The Norton Backup 1.2 for Windows	84.
3146	☐ The Norton Utilities 6.0	115.
3425	☐ Q&A 4.0	249.
7999	☐ Norton Anti-Virus 2.0	84.



Hayes ... NCP

7983 ☐ Smartcom EXEC 2.1—A complete communications program with an extensive list of features, supported terminal emulations, file transfer protocols, an easy-to-use interface, and Windows support ... \$75.

PC CONNECTION®

The idea was ours,

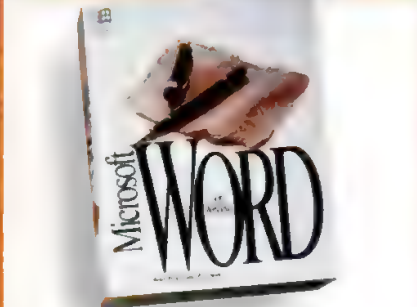


Symantec ... NCP
 2559 Norton Desktop 2.0 for Windows—Adds drag and drop icons, an extensive collection of Norton's best utilities, complete virus protection, and Windows 3.1 support ... \$99.
 4431 Norton Desktop 2.0 for Windows 3.1 165.

2359	☐ The Norton Desktop 2.0 for Windows ...	99.
4431	☐ Norton Desktop 2.0 & Windows 3.1	165
8378	☐ Norton PC Anywhere IV 4.5.	119.
Systems Compatibility ... NCP		
3949	☐ The Writer's Toolkit 2.0 for Windows	79
Teleware ... NCP		
9847	☐ M.Y.O.B. for Windows	139.
TIMESLIPS ... NCP		
2987	☐ Timeslips III 4.0.	195.
5037	☐ TimeSheet Pro for Windows	135
Timeworks ... NCP		
6253	☐ Publish-It! 2.0	85.
Tool Technology ... NCP		
3863	WinTools 1.0 for Windows (3 1/2" only)	119.
Touchstone Software ... NCP		
7420	☐ Check It 3.0	85.
Traveling Software ... NCP		
4407	☐ LapLink Pro 4.0	95.
WordPerfect Corporation ... NCP		
4214	☐ WordPerfect Office PC	89.
3804	☐ WordPerfect 5.1	269.
3494	☐ WordPerfect 5.1 for Windows	279.
1466	☐ WordPerfect 5.1 Additional User	199.
XTREE ... NCP		
6161	☐ XTree Gold 2.5	95.

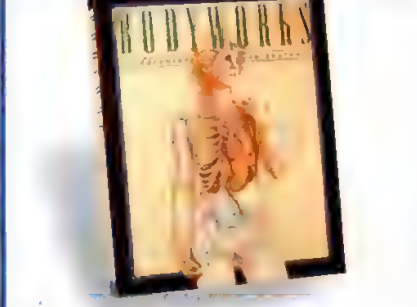
RECREATIONAL/EDUCATIONAL

Abracadata ... NCP		
3641	☐ Design Your Own Railroad	39.
3629	☐ Design Your Own Home-Architecture 3.0	49.
3631	☐ Design Your Own Home-Interiors 1.0	49.



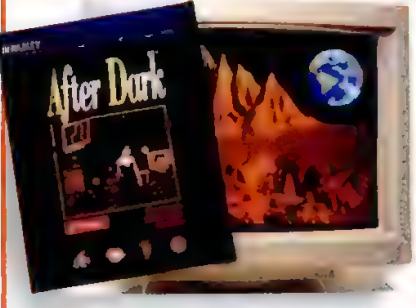
Microsoft ... NCP
 6195 Word 2.0 for Windows—Everyday tasks are easy with the customizable toolbar, drag & drop movement of text, & instant character & page formatting from the Ribbon & Ruler. Includes drawing, charting & WordArt. ... \$309.

Broderbund ... CP		
3340	☐ Kid Pix	\$35.
8068	☐ Where in World is Carmen Deluxe	49.
3809	Where in World is Carmen Deluxe (CD-ROM)	65.
1836	☐ Where in America's Past is Carmen	39.
5851	☐ SimCity from Maxis	29.
4388	☐ SimAnt from Maxis	39.
4411	☐ SimEarth for Windows from Maxis	45.
Davidson & Associates ... NCP		
3947	☐ Math Blaster Plus	29.
4183	☐ KidWorks	29.
Electronic Arts ... NCP		
3038	☐ Earl Weaver Baseball II	35.
4534	☐ Mavis Beacon Teaches Typing 2.0 (CP)	35.
3031	☐ Mavis Beacon for Windows	45.
3023	☐ ChessMaster 3000	35.
3032	☐ ChessMaster 3000 for Windows	39.
Harvard Associates ... NCP		
2324	☐ PC Logo 3.0	59.
HyperGlott Software ... NCP		
(French, German, Italian, Spanish available.)		
	☐ Word Torture for Windows	ea. 34.
	☐ Word Torture 3.0	ea. 29.
ICOM Simulations ... NCP		
3717	Sherlock Holmes, Consulting Detective (CD)	39.
Knowledge Adventure ... NCP		
1483	☐ Sports Adventure 1.0	55.
3861	☐ Knowledge Adventure 1.0	55.



Software Marketing Corp. ... NCP
 5145 Bodyworks 1.0—Explore the human body with a comprehensive look at its systems, structures and functions. Includes detailed graphics, animations, and a vast database of terminology, definitions and descriptions \$45.

Microsoft ... NCP		
7881	☐ Entertainment Pack I for Windows	29.
4079	☐ Pack II	29.
	4077 ☐ Pack III	29.
2858	☐ Flight Simulator 4.0	39.
Penton Overseas ... NCP		
	☐ VocabuLearn/ce Levels I & II (French, Italian, German, Spanish, Russian, Hebrew and Japanese)	ea. 35.
Personal Training Systems ... NCP		
Training tutorials - beg. to adv. for Windows, Excel, PageMaker, & Lotus 1-2-3 (3 1/2")		
	ea.	65.
Sierra ... CP		
9466	☐ Space Quest IV (VGA)	45.
3193	☐ Police Quest III (VGA)	45.
Software Toolworks ... NCP		
3294	☐ Game Pak (5 games in one)	32.
5032	Miracle (piano teacher) (incl. kybd.)	339.
Spectrum Holobyte ... NCP		
4834	☐ Super Tetris	29.
4833	☐ Super Tetris for Windows	29.
Toyogo ... NCP		
2701	☐ Nemesis Go Master 5.0 for Windows	35.
7674	☐ Nemesis Go Master 5.0	35.
True BASIC, Inc. ... NCP		
	☐ Kemeny/Kurtz Math Series	ea. 45.
Walt Disney Computer Software ... CP		
2629	☐ Mickey's 123's	29.
2624	☐ Mickey's ABC's	29.
4398	☐ The Animation Studio	79.
4416	Sound Source	29.



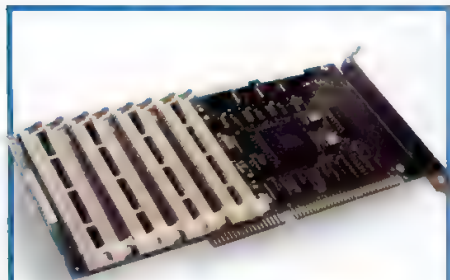
Berkeley Systems ... NCP
 4885 After Dark 2.0 for Windows—New! 40 incredible displays to prevent screen burn-in. 5 New Displays, Digital Sound, True Color Graphics, WallZapper, new fish, and MultiModule. DOS blanking to black ... \$29.

HARDWARE

Warranties listed next to manufacturer.

American Power ... 2 years		
7108	Smart UPS 400	339.
7105	Smart UPS 600	425.
3858	Back-UPS 400	185.
3823	Back-UPS 600	299.
Appoint ... limited lifetime		
2469	Thumbelina PC	62.
2480	MousePen Pro PC	62.
ATI Technologies ... 2 years		
9821	VGA Basic-16 (640 x 480, 16 colors)	69.
9985	VGA Integra (1024 x 768, 16 colors)	95.
2706	VGA Wonder XL (with 1 MB)	199.
2382	Graphics Vantage VGA (with 1 MB)	359.
9822	8514/Ultra (with 1 MB) (requires VGA)	419.
2012	Graphics Ultra with VGA (with 1 MB)	479.
1825	2400etc/i Modem (with 9600 SendFax)	139.
9620	9600etc/e Modem	369.
3902	Stereo•F/X	149.
3900	VGA Stereo•F/X (w/512K, upgrd. to 1 MB)	329.
Boca Research ... 5 years		
7150	BOCARAM/AT PLUS (2 MB)	199.
7139	(4 MB)	299.
	7138 (8 MB)	499.
6998	I/O Board for AT	49.
6999	I/O Board for Microchannel (S/S/P)	95.
8380	BasicVGA (256K, 640 x 480)	49.
8381	SuperVGA (1 MB, 1024 x 768)	119.
3859	2400 Internal Modem (V.42, MNP Level 5)	85.
2502	2400 Baud Internal Modem	49.
4001	2400 Baud External Modem	59.
Bravo Communications ... 2 years		
7400	2 Position Laser Compatible Switch Box	109.
Brown-Wagh ... 1 year		
8578	Creative Labs Sound Blaster	109.
2336	Creative Labs Sound Blaster Pro	189.
Caere ... 1 year		
8158	Typist Plus Graphics	389.
Canon ... 1 year		
We are an authorized Canon Service Center.		
7894	BJ-10ex Printer (4.6 lb.)	329.
7897	BubbleJet Ink Cartridge (BJ-10ex)	23.
7896	BJ-10ex Sheet Feeder	75.
Cardinal ... 1 year		
2719	MB2296SR Internal Send/Receive Fax	105.
1132	386-SX-16 Motherboard ØK	279.
1197	386-SX-25 Motherboard ØK	349.
1480	Cardinal 9600 Internal Modem	329.
2783	Cardinal 9600 External Modem	349.
CH Products ... 1 year		
7935	Game Card III Auto	33.
7340	FlightStick	45.
Curtis ... lifetime		
1708	Ruby-Plus SPF-2+	65.
7358	Command Center SPF-4	89.

the savings are yours.



Intel ... 5 years

1086 Matched Memory Classic Memory Board OK—Great performance with a great price to match. EMS 4.0 compatibility built in to the hardware for up to 90% faster processing. Expandable to 8 MB using 1 MB SIMMs ... \$139.

Cyrix Corporation ... 5 years

MATH COPROCESSORS

9875	FasMath 83D87-25	159.
9876	FasMath 83D87-33	169.
9877	FasMath 83S87-16 (SX compatible)	99

Epson ... 2 years

We are an authorized Epson Service Center.

1906	FX-850 (80 col., 264 cps, 9 pin)	319.
1904	FX-1050 (136 col., 264 cps, 9 pin)	449.
2358	LQ-570 (80 col., 252 cps)	289.
2361	LQ-870 (80 col., 330 cps)	489.
2357	LQ-1170 (136 col., 330 cps)	669.
5184	LX-810 (80 col., 180 cps, 9 pin)	185.

Everex ... 1 year

1683	Tempo LX Notebook (5 MB, 60 MB HD)	call
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Hauppauge Computer ... 1 year

9870	25 MHz 386N Motherboard for AT (1 MB)	729.
9034	33 MHz 386N Motherboard for AT (1 MB)	789.
3670	33 MHz 486 Motherboard for AT	1229.
4008	Win/TV	439.

Hayes ... 2 years

7391	ULTRA 96 Modem	669.
5024	ULTRA 144 Modem	799.
1345	OPTIMA 24 Modem	155.
3522	OPTIMA 96 Modem	389.
9884	Pocket Edition 2400	119.

Hewlett-Packard ... 1 year

3175	DeskJet 500C (color) (with toner)	749.
3957	LaserJet IIP Plus (with toner)	879.
9993	LaserJet IIIP (with toner)	1099.
6754	LaserJet III (with toner)	1599.

Intel ... 5 years

3864	14.4EX Modem	549.
6421	2400B MNP Internal Modem	189.
6420	2400EX MNP Modem	225.
7880	9600EX Modem	469.
5336	Above Board Plus 8 2 MB	379.
5342	Above Board Plus 8 I/O 2 MB	399.
1086	Matched Memory Classic Memory Brd. OK	139.
7782	SatisFAXtion (fax board)	349.
8903	Matched Memory 4 MB (PS/2)	199.
	Matched Memory (for LaserJet IIP, III, IIIP, IIID)	
1810	1 MB	89.
3076	1787 2 MB	149.
3076	Snap-In 386 (for PS/2 50/60 & IBM AT)	389.
3358	Power Pak (Snap-In 386 & Above Board Microchannel 4 MB)	799.
	MATH COPROCESSORS	
7385	80287XL (16 MHz 80286 CPU's)	89.
4750	80387SX (16 MHz 80386SX CPU's)	129.
6830	80387SX-20 (20 MHz 80386SX CPU's)	139.
5409	80387DX	219.

Kensington Microware ... 1 year

Full line available. Partial listing

4973	PowerTree 20 (6 outlets, EMI/RFI Filtering)	\$27
2582	Master Piece Plus	99.
7899	Expert Mouse serial	99. 7900 bus
3311	MasterStand	59.
3312	LaserStand (for HP LaserJet)	125.

Keytronic ... 3 years

4518	101 Plus Keyboard	99.
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Kraft ... 5 years

5801	Game Card (2 ports)	27
5813	Game Card with Thunderstick	49
5800	3 button Thunder Joystick	29.

Logitech ... limited lifetime

3996	Trackman 2 (combo)	84.
2343	Trackman Portable	99
7975	ScanMan 256	289
1322	FotoMan (camera for your PC)	549.
4727	Kids Mouse	45
3295	MouseMan (combo)	69. 9766 (cordless)

Megahertz ... 5 years

3020	T224FM 96/24 Pocket Fax Modem	249
1187	T324FM 96/24 Fax Modem (Toshiba Lptps.)	269.

Micron Technology ... 2 years

7595	2 MB Expansion for HP LaserJet IIP or III	119.
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Canon ... 1 year

7894 BJ-10cx Printer—New enhanced version of the popular 4.6 lb. printer provides laser-like print quality (up to 360 dpi) on plain bond paper, envelopes or transparencies. Available in white or gray ... \$329.

Microsoft ... lifetime

7597	Microsoft Mouse (bus or serial)	85
2897	Mouse with Paintbrush (bus or serial)	99.
2898	Mouse with Windows 3.0 (bus or serial)	149
1896	Ballpoint Mouse (serial only)	119

MicroSpeed ... 1 year

2763	MicroTRAC (serial & PS/2 interface)	57
6330	PC-TRAC Trackball (PS/2)	79
6007	serial	75. 6008 bus

Microtek ... 1 year

2736	ScanMaker 600G (gray-scale scanner)	759.
2739	ScanMaker 600Z (color scanner)	1249
2740	ScanMaker 1850 (slide scanner)	1649.

Mouse Systems ... lifetime

5997	Trackball (1 yr. wnty.) serial	49. bus
3213	PC Trackball II (serial)	69
7878	PC Mouse III (serial)	89. (bus)

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960M

SALES 603/446-0004 FAX 603/446-7791



Practical Peripherals ... lifetime

2425 PM14400FXSA Modem/Fax—Get ultra high speed 14,400 bps data transmission as well as Group III S/R fax capabilities in one integrated and affordable package. Includes QuickLink II for modem and fax communications ... \$399.

NEC ... 2 years

3637	CDR-36M Portable CD-ROM Drive	399.
3651	CDR-73M CD-ROM Drive	589.
2478	CD Gallery with CDR36 for PC	579
4252	Multisync 3FGX Monitor (14")	689.
4249	Multisync 4FG Monitor (15")	799.

Okidata ... 1 year

We are an authorized Okidata Service Center.

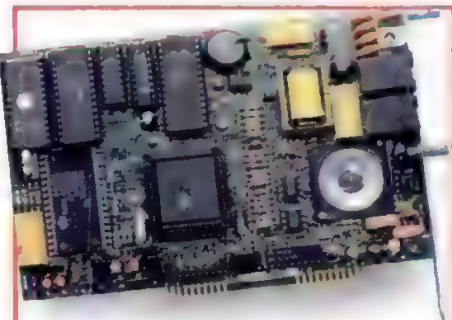
5093	OL400 Page Printer (4 ppm)	649
5094	OL830 Page Printer (8 ppm)	1329
3025	Toner Cartridge	25.

Orchid Technology ... 4 years

7863	ProDesigner VGA IIS (with 1 MB, includes RAMDAC chip)	249.
4071	Fahrenheit 1280i with 1 MB	365.

Pacific Data ... lifetime/60 day MBG

5072	25 Cartridges in One! (for DeskJet 500)	105.
5071	25 Cartridges in One! (for DeskJet Plus)	105.
6779	25 Cartridges in One! (LJ II, IID, IIP, III, IIID)	269.
	Memory upgrade for LJ IIP, III, IIID, IIIP:	
7055	2 MB	139. 7759 4 MB
	Memory upgrade for LaserJet II/IID:	
6838	2 MB	245. 6836 4 MB
7158	Pacific Page PE (LJ IID, IIP, III, IIID, IIIP)	299.
9833	Pacific Page XL (w/accelerator board)	699.



Prometheus ... 2 years

1222 Pro/Modem Ultima Home Office—Integrated system of data, fax & voice. 14,400 bps data modem with V.42bis/MNP 5 data compression & error correction, plus 9600 bps send/receive fax, & full voice capability ... \$489.

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800/800-0004.

PC Power & Cooling ... 2 years

REPLACEMENT POWER SUPPLIES

3203	Turbo Cool 200	\$149.
7915	Turbo Cool 300	159.

Practical Peripherals ... lifetime

3103	2400 Baud Internal Modem	79.
3102	2400 Baud External Modem	99.
8993	2400 Baud Internal Modem (V.42 bis)	115.
8994	2400 Baud External Modem (V.42 bis)	125.
8132	PM2400 Pocket Modem	109.
2266	PM9600 Internal Modem	275.
7934	PM9600SA Modem	289.
2264	PM2400FX96 (int. modem/fax)	95.
1344	PM2400FX96SA (ext. modem/fax)	99.
3803	PM14400FX96 (int. modem/fax)	359.
2425	PM14400FXSA (ext. modem/fax)	399.

Prometheus ... 2 years

1222	ProModem Ultima Home Office	489.
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Targus ... lifetime

1305	Universal Notebook (computer case)	69.
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TheComplete PC ... 2 years

5828	TheComplete Communicator	299.
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Tripp Lite ... 2 years

6199	Isobar 4-6 (4 outlets, Gold Seal Warranty)	49.
6200	Isobar 6-6 (6 outlets, Gold Seal Warranty)	59.
6201	Isobar 8-12 (8 outlets, Gold Seal Warranty)	69.

Video 7 ... 7 years

9768	VRAM II VGA 1 MB	329.
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Zoom Telephonics/Delrina Tech./Calera

Zoom 2400 Fax Modem/Delrina WinFax Pro
Calera Fax Grabber Bundle—Complete Windows
fax solution! Get this 9600 bps S/R fax with
2400 baud modem along with Delrina's
WinFax Pro & Calera's Fax Grabber at a special

price. WinFax Pro was named "Best of 1991"
by both PC Magazine & Windows Magazine. Fax
Grabber converts fax images to many popular
text formats. Also includes a copy of Norton
Desktop. Offer good through 5/31/92.
4100 Int. Bundle \$239. 4098 Ext. Bundle \$239.

Mountain Network Solutions ... 2 years

2917	40-120 MB Internal Tape Drive	259.
3812	FS8500 IDE Tape Backup (304M)	569.

6153	DC2120 Tape Cartridge (5 pack)	149.
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Pacific Rim ... 1 year

1304	1.2 MB External (for any parallel port)	239.
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2761	1.44EX MB External (for any parallel port)	239.
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Quantum ... 2 years

8304	Plus Hardcard II XL 50 MB (9 ms)	299.
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8287	Plus Hardcard II XL 105 MB (9 ms)	449.
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4060	105 MB Drive Kit for MC PS/2's (13 ms)	789.
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TEAC ... 1 year

4670	1.44 MB Drive for PC/XT (3 1/2")	59.
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4326	1.44 MB Drive for AT (3 1/2", w/Bastech)	79.
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4951	720k Drive for PC/XT (3 1/2")	55.
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6951	1.2 MB Drive for AT (5 1/4")	65.
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4414	3 1/2" 5 1/4" Dual Floppy Drive	165.
------	---------------------------------	------

MEMORY

6556	256k DRAM (100 ns, set of 9)	19.
------	------------------------------	-----

5510	1 MB x 9 SIMMs (80 nanosecond)	49.
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2497	4 MB x 9 SIMMs (80 nanosecond)	179.
------	--------------------------------	------

5746	1 MB Chips (80 ns, set of 9)	49.
------	------------------------------	-----

DISKS/MEDIA

3M ... lifetime

3943	DC2000	17.	1581 DC2120	24.
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Fuji ... lifetime

2214	3 1/2" DS Disks (10)	9.	2242 (50)	32.
------	----------------------	----	-----------	-----

2215	3 1/2" HD Disks (10)	15.	2241 (50)	59.
------	----------------------	-----	-----------	-----



IOMEGA ... 1 year

2224 Bernoulli II Transportable 90 MB—Rugged
and built to last, this drive will absorb 1000 g's
of shock and provide 90 MB of portable
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Requires adapter card \$799.

2243	3 1/2" DS Color Disks (Qty. 10)	10.
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2239	3 1/2" HD Color Disks (Qty. 10)	18.
------	---------------------------------	-----

	Fuji 1/4" Data Cartridges	call
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Sony ... lifetime

3292	5 1/4" HD Disks (Qty. 10)	12.
------	---------------------------	-----

3297	3 1/2" DS Disks (10)	9.	6148 (30)	25.
------	----------------------	----	-----------	-----

3298	3 1/2" HD Disks (10)	15.	6375 (30)	42.
------	----------------------	-----	-----------	-----

8185	QD2040 Tape Cartridge	14.
------	-----------------------	-----

1895	QD2120	21.
------	--------	-----

6715	QD6150	23.	1602 QD6250	29.
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DRIVES

Colorado Memory Systems ... 1 year

4194	Jumbo 120 Tape Backup	199.
4354	Jumbo 250 Tape Backup	269.

Conner Peripherals ... 1 year

2339	CP30104 120 MB IDE HD (19 ms)	399.
1337	CP3204 200 MB IDE HD (16 ms)	599.

IOMEGA ... 1 year

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2224	Bernoulli II Transportable 90 MB	799.
2616	Internal 90 MB Bernoulli	799.

2500	PC2B Controller	199.
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2530	90 MB Cartridge	149.
------	-----------------	------

2467	90 MB Cartridge Tripak	439.
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3574	Ext. 2400 Baud V.42/9600 Baud Fax	145.
1168	2400 Baud External Modem	69.
3386	FaxModem AFC (2400 baud modem, 9600 send, 4800 receive fax)	69.
3075	9600 V.32 Turbo Internal Modem (2 yr.)	329.
1494	9600 V.32 Turbo External Modem (2 yr.)	329.
4100	24/96 Internal Fax Modem/WinFax Pro/Calera Fax Grabber Bundle	239.
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CIRCLE 167 ON READER SERVICE CARD

3.5-Inch Rewritable Optical Drives

READY FOR PRIME TIME?

PHOTOGRAPHY: THOM O'DONNOR

The new 3.5-inch rewritable optical drives are smaller, cheaper, and quicker than their 5.25-inch predecessors. But these 128MB-capacity drives are going to have to come down in price and move up in performance to challenge their real competitors: removable-media options such as the Bernoulli Transportable 90. PC Magazine Labs tests eight products.

by M. David Stone

The big news in rewritable optical storage technology in the last year has been the introduction of 3.5-inch magneto-optical (MO) drives. Smaller and cheaper than their 5.25-inch cousins, 3.5-inch MO disks also hold less data—128MB compared with the larger format's 650MB. But what's lost in capacity on these smaller drives is somewhat offset by an increase in performance over the 5.25-inch systems.

The question, of course, is whether the technology has matured to a point where the combination of price, performance, and features makes 3.5-inch rewritable optical drives worth your consideration. The short answer for the mainstream desktop is: not yet.

The long answer is more complicated. The 3.5-inch MO drive is almost universally envisioned as a device for single

users, or at most, for small networks. Indeed, the vision would be enticing—if the price were low enough. The initial cost, however, is one area where these drives fail to best the price of removable media options such as Iomega's Bernoulli Transportable 90, a competitor in many of the same markets. Compared with the 90MB Bernoulli Transportable 90's \$1,414 price (including controller), 3.5-inch MO drives require a more costly initial investment, averaging about \$2,300 for a complete subsystem. In addition, 3.5-inch MO drives are slower performers than their Bernoulli competitor.

Despite this, the 3.5-inch MO disk has certain advantages. Most vendors estimate a disk life of 10 to 15 years for the cartridges they sell, and many also claim 10 million erase/read/write cycles per cartridge. The disk is also notable for its extreme portability; a single cartridge is about the size of a stack of two 3.5-inch floppy disks and about two-thirds the length and width of a 90MB Bernoulli cartridge. The 3.5-inch MO disk also has the advantage of a relatively low cost per megabyte. At an average of \$60 to \$70 per 128MB disk (street price), the cost works out to about 50 cents per megabyte, compared with about \$160 for one 90MB Bernoulli cartridge, or \$1.80 per megabyte (street price).

If you need to carry large files between locations, or if you use graphics or other disk-eating applications, the portability and low per-megabyte costs are important advantages. You can also use these MO drives for near-line or secondary storage, a function for which you can also use a Bernoulli unit or a removable hard disk. That's a useful capability for any file, but it is particularly so for large files (such as graphics images) that you don't use regularly; you don't want them to take up hard disk space, but you access them often enough that copying them back to your hard disk from tape backup systems or floppy disks will be a hassle. Because the cartridges are removable, they offer the same security as a Bernoulli drive or removable hard disk for government use or in other sensitive operations.

The slower speed of the 3.5-inch MO drives (47- to 77-millisecond average access times), however, makes them less effective choices as storage growth options for primary storage; Iomega reports that this is the number-one reason users buy its 90MB Bernoulli drive, which has a 19-ms. average access time. The rela-

tively low capacity of each 3.5-inch MO cartridge means that this is not your best archival backup option for anything but relatively small disks, either.

Much of the potential value of rewritable optical disks lies in the promise of interchangeability—the idea that you can move large amounts of data from one manufacturer's system to another simply by popping the disk out of one vendor's drive and putting it in another's, without

worrying about matching drives on both systems. The industry has a long way to go before optical disks are as interchangeable as floppy disks, but that is the long-term promise.

REVIEW CRITERIA

To be included in this roundup, each drive had to follow the proposed ISO (International Standards Organization) standards. Ken Hallam of ENDL Associates, also the chairman of X3B11 (the Removable Optical Media Standards Committee of

HIGHLIGHTS: 3.5-Inch Rewritable Optical Drives

■ With capacities of 128MB, these 3.5-inch MO drives hold about 500MB less data than the 5.25-inch systems we reviewed last year ("Magneto-Optical Drives: Fulfilling the Promise of Rewritable Optical?", June 11, 1991). But with rated average access times of 47 to 77 milliseconds and list prices averaging about \$2,300 for an external unit (about \$2,000 for an internal model), the 3.5-inch drives are also faster and cheaper.

■ Technically, these drives are similar to 5.25-inch rewritable optical systems, but in the marketplace their real competition is removable media such as Iomega's Bernoulli Transportable 90. Either alternative is appropriate as a secondary storage option or in installations where portability or security are required.

■ At a cost of \$1,414 (including a controller), however, the 90MB Bernoulli drive is a much cheaper initial investment. On the price front, Syquest will also offer a competitive challenge to these MO drives when it introduces its 105MB removable drive, which will sell for under \$1,000 on the street.

■ Because of the 3.5-inch MO disk's low cost per megabyte (about 50 cents versus \$1.80 for a Bernoulli cartridge), these MO drives currently have the advantage over removable media for users who deal with many large files, such as graphics files.

■ Don't expect much interchangeability from the products reviewed in this

roundup, although that is where much of the potential value of 3.5-inch MO drive technology lies. Current proposed standards cover only the media and physical format of the rewritable disk. Compatibility on the logical-format level is another issue entirely; ANSI is working on a standard, but the proposal had not yet been approved.

■ The lack of interchangeability extends to prewritten O-ROM disks. While the physical format for this medium is defined, the logical format is not. Currently, you can't expect every O-ROM disk to work with every 3.5-inch MO drive package.

■ 3.5-inch MO drives achieve faster access times than their 5.25-inch counterparts, largely because they incorporate a split optics design. This design moves the relatively massive laser diode and much of the rest of the optical subsystem off the moving sled, resulting in a much lighter head and much less mass for the sled to move.

■ Four vendors provide the drive mechanisms found in the eight systems reviewed here. IBM is the sole company to use its own drive mechanism, the IBM MD-3125A, with its system. The Sony SMO-P301 is the mechanism behind the units from MicroNet, PLI, Pinnacle, and Procom. The Acumen and OCEAN units both use the MOST RMD-5100S mechanism from Nakamichi. The Relax Technologies entry was the only drive reviewed that uses the Ricoh RO-3010E. ■

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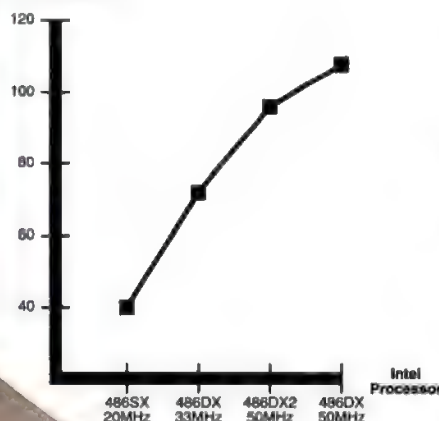
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HARDWARE MAGNETO-OPTICAL DRIVES

**These eight 3.5-inch
external MO drives
have prices ranging
from nearly \$1,500 to
almost \$3,000.**

ANSI), says that the ISO standard, as well as the proposed ANSI (American National Standards Institute) and ECMA (European Computer Manufacturers Association) standards, are all expected to be adopted by mid-1992. They should be essentially identical. The standards define the physical format for the 128MB single-sided magneto-optical disks used by 3.5-inch MO drives.

Besides following the ISO standards, each package had to be a complete subsystem, consisting of a drive, software, manuals, cables, and any other component needed to make it work. All the drives use SCSI interfaces, so we required the vendors to send their SCSI host adapters as well. Although most manufacturers and industry observers expect the majority of 3.5-inch MO drives to find their way inside computer systems, this overview is confined to external versions of the drives. We focus on external drives because some vendors' internal versions were not available when our testing began, usually because the companies did not yet have the bezels and other paraphernalia needed to mount the drives internally. At press time, MicroNet and Procom had not yet released internal versions. Of those that had internal units, drives based on the Ricoh, Sony, and IBM drive mechanisms can fit in a 3.5-inch half-height bay; the MOST-based units require a 5.25-inch half-height bay.

Of the eight packages that fit our filter, the MicroNet MO-128/DOS, PLI Infinity Optical 3.5-Inch, Pinnacle Micro REO-130S, and Procom MEOD128 all use the Sony SMO-P301 3.5-inch drive mechanism. The Acumen AcuOptic 128E and the OCEAN Vista 128 use the MOST RMD-5100S drive mechanism from Nakamichi and proved to be the fastest competitors. The Relax Sierra Optical 128 uses the Ricoh RO-3010E, and the IBM PS/2 3.5-Inch Optical Rewritable Drive uses IBM's own MD-3125A drive mechanism.

IBM, MicroNet, PLI, and Procom include their own SCSI host adapters with their units. Acumen and OCEAN employ Future Domain boards, while Pinnacle supplied a TenTimes SCSI host adapter for our benchmark tests. Relax sent two Trantor boards—one a standard SCSI host adapter and the other a parallel port SCSI adapter. Some of the vendors bundle formatting, cartridge eject, or backup utilities with their products, while MicroNet optionally provides a full-fledged backup

application in the form of the \$99 *ARCserve/Solo*. These external versions have list prices ranging from nearly \$1,500 to almost \$3,000, including the SCSI host adapter. The internal subsystems are about \$100 to \$300 dollars less than their external twins and range in price from about \$1,300 to about \$2,800.

Several other packages were not shipping in time for our tests but should be on the market by the time you read this. These include products (which will primarily use existing drive mechanisms) from Applied Programming Technologies, Chinon America, Consan, Dynatek Automation Systems, Epson America, FWB, Storage Dimensions, Optima Technology Corp., and TenTime Controllers. Panasonic Corp., which will be using its own drive mechanism, should also be shipping its drive by the time you read

this. Sony Corp. of America and TEAC America expect to introduce drive packages based on their respective drive mechanisms for the end-user market later this year. Xyxis Corp. had a 3.5-inch drive package available but refused to participate in this review.

If you would like to be your own systems integrator, you can even buy any of these drives with just the SCSI interface, and then purchase a SCSI host adaptor and software separately. (Adaptec, Corel Systems Corp., Future Domain Corp., and Western Digital Corp., for example, sell kits that include a SCSI host adapter and software that the companies say will work with any 3.5-inch MO drive.) In general, however, you're better off buying a complete kit, since you'll have one source to go back to if you run into problems.

WHY COMPATIBLE DISKS AREN'T

As mentioned, the promise of interchangeability is key to this technology. The problem is that for full interchangeability, you need compatibility on several levels. The ANSI, ECMA, and ISO standards cover only the disk and its physical format. You also need compatibility on the logical-format level and for the SCSI adapter card's command interface. Currently, there is no standard for either of these levels. And until there is, packages that use different partitioning schemes or file structures, or use SCSI cards with different command interfaces, will not be able to read each other's disks.



A 3.5-inch MO disk has the same length and width as a 3.5-inch floppy disk but is approximately twice as thick. At 3.5 inches square, it is almost two-thirds the length and width of the 5.5-inch-square 90MB cartridge for the Bernoulli Transportable 90 but packs 40MB more data.

HARDWARE MAGNETO-OPTICAL DRIVES

The good news is that ANSI is working on a standard for logical formats that will define a standard for volume labels and partitioning, a file format standard, and even a common booting standard (which would allow bootable partitions for DOS, Macintosh, and Unix all on one disk, for example).

According to Ed Beshore of Hewlett-Packard Co., chairman of the X3B11.1

ANSI subcommittee, the proposal for a logical format for WORM (write once, read many) and re-writable media could be approved by the time we publish this article. Beshore points out that the ANSI committee is working in conjunction with its ECMA

counterpart so that the ANSI and ECMA logical-format standards will be the same. Once ANSI and ECMA produce identical standards, ISO should follow quickly.

For the moment, however, individual vendors have paid little attention to interchangeability. Many vendors are looking to the IBM scheme for an interim logical format standard (IBM and Relax were the only two vendors currently using it, though). These companies plan to modify their software to work with the IBM format

in addition to the format the software already uses, but you won't see much interchangeability in the products reviewed here.

That lack of interchangeability extends to O-ROM (optical read-only memory) disks developed for the MO drives we reviewed here. These

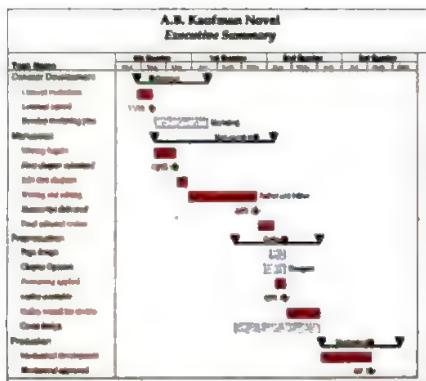
are similar in concept to CD-ROM but different in detail. O-ROM is a publishing medium, just like CD-ROM. The main differences between the two are that

O-ROM drives use a different format and different-size disk than a CD-ROM unit and have far less information per disk—about 123MB, compared with about 600MB for a CD-ROM disk. The O-ROM standard also allows a partial O-ROM, which means that a single disk can have both O-ROM and rewritable areas, in any proportion.

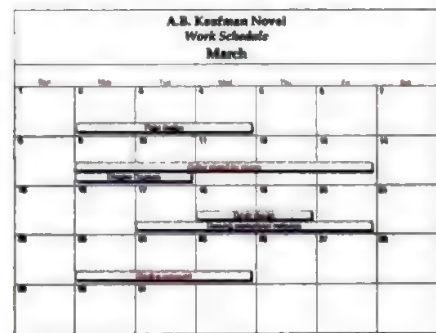
As with rewritable 3.5-inch disks, the physical format for O-ROM disks is fully defined, but the logical format is not. According to Beshore, that means you can't expect any O-ROM disk picked at random to work with any given drive package. A case in point, the O-ROM disk we used for our tests worked only with the IBM and the Relax Technologies packages. None of the packages that used the Sony drive mechanism could read the disk, even though we got the disk from Sony. And it is no coincidence that the Ricoh-based Relax Technologies offering uses the same logical-format scheme as IBM. The point is that the logical format for the O-ROM disk and the drive package must match. O-ROM compatibility will come in tandem with compatibility for exchanging rewritable disks.

For the moment,
individual vendors
have paid little
attention to
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HARDWARE MAGNETO-OPTICAL DRIVES

The MOST drive mechanism does not support O-ROM. You will sometimes see those drives that do support O-ROM referred to as multifunction drives. The reference is probably inevitable; after all, a drive that has both O-ROM and rewritable features is offering multiple functions. But don't confuse the multiple functions in 3.5-inch drives with what you'll find in 5.25-inch multifunction drives.

3.5- VS. 5.25-INCH MO DRIVES

Multifunction 5.25-inch optical drives combine rewritable and WORM capabilities on a single drive. There are no 3.5-inch WORM drives—multifunction or not. The 128MB maximum capacity of the ANSI, ECMA, and ISO standard is too small to make a WORM drive useful. Even the nonstandard 256MB 3.5-inch drive that MOST plans to sell offers a notably smaller capacity than most WORM drives.

Unlike the 5.25-inch drives, which use disks that have either 512 or 1,024 bytes per sector, the 3.5-inch MO disks are limited almost entirely to disks with 512 bytes per sector. While 1,024-byte sector disks are an option in the 3.5-inch speci-

cation, none of the vendors represented here support it.

Aside from these variations—as well as the smaller size, smaller capacity, and different ANSI, ECMA, and ISO standards—3.5-inch drives differ little from the 5.25-inch drives we covered last year ("Magneto-Optical Drives: Fulfilling the Promise of Rewritable Optical?", June 11, 1991). All of these 3.5-inch drives use the MO technology predominating among 5.25-inch rewritable optical drives. (For an update on what's happening in the 5.25-inch market, see the sidebar "Technology Outlook: 5.25-Inch Rewritable Optical Drives.")

Briefly, MO drives simultaneously use a laser and magnetic field to write to and read from the disk. The disk stores information in magnetic domains in much the same way a hard disk does. But the MO drives use a magnetic field that would normally be too weak to change the orientations of on-disk magnetic domains.

To write to the disk, the MO drive's laser raises the recording layer's temperature to its Curie point, making the record-

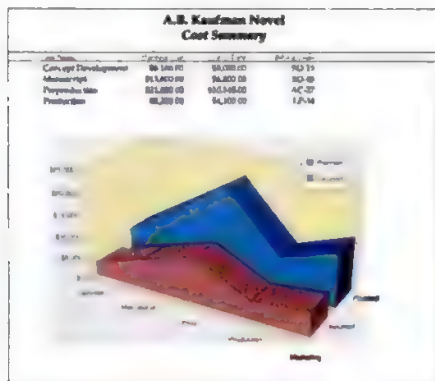
ing layer's *coercivity* (resistance to change) drop to zero. It can then use the drive's weak magnetic field to write information to the disk. As with 5.25-inch drives, these 3.5-inch drives use a two-pass writing scheme, setting all the magnetic domains to the same direction on the first pass, then setting just those that must be changed on the second pass.

To read from the disk, the drive takes advantage of the laser light's polarization. When polarized light reflects off a metal surface in a magnetic field, the magnetic field will rotate that plane of polarization; the direction of rotation will depend on the field's orientation (whether its north pole is up or down). This phenomenon is called the *Kerr effect*. MO drives read data by bouncing a laser off the disk and detecting the rotation caused by the Kerr effect. (For more details on how this technology works, see our review in the June 11, 1991, issue.)

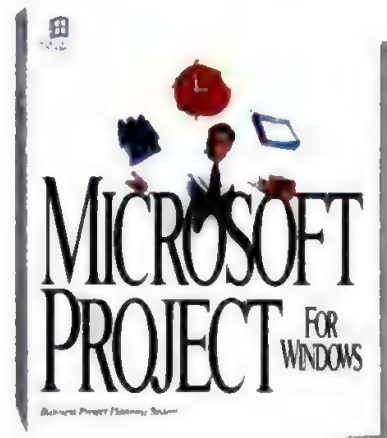
LENSES AND MIRRORS

There is one technology difference between most of the 5.25-inch drives we looked at last year and the 3.5-inch drives in the current roundup: a feature called

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split optics (as explained in the diagram "Split Optics: Decreasing the Burden, Increasing the Speed").

On most 5.25-inch drives, the optics go on a sled that moves across the disk and finds the right track onto which to focus the laser. Unfortunately for performance, part of the optics is the laser diode, which is massive enough to add considerably to the difficulty of starting and stopping the sled. This extra mass is largely responsible for the 57- to 109-millisecond average access times produced by most of the 5.25-inch drives we reviewed last year. (As points of comparison, the typical high-capacity hard disk today has an average access time hovering around 15 ms.; at the other end of the spectrum, CD-ROM drives are rated at about 350 to 400 ms.)

In sharp contrast to the 5.25-inch products we looked at last year, all four of the 3.5-inch drive mechanisms use split optics. The split optics design takes the laser diode off the sled, which now moves only the focusing lenses and mirrors. The difference shows in both the claimed average access times of 47 to 77 ms. and the times we measured with our tests, from 37 to 57 ms.

The IBM PS/2 3.5-Inch Optical Rewritable Drive, which is rated at a slow 77 ms., managed 57 ms. on PC Magazine Labs' DOS Disk Access benchmark test. The two packages using the MOST drive managed about 37 ms., though the drive is rated at 47 ms. The four packages using the Sony drive came in at 48, 50, 53, and 55 ms., all close to the 50-ms. average access rating. The only package we looked at that is based on the 43-ms. Ricoh drive was the Relax Sierra Optical 128. Unfortunately, the drive does not support interrupt 13h (which controls hard disk calls made by certain programs) and could not yield a measurement for this test.

Just as important for reading or writing large amounts of data is the drive's rotation rate, one of the factors that helps determine the average access time. (Specifically, it determines the drive's *average latency*, the amount of time it takes on average to rotate the disk to the appropriate sector in a given track. The other component of average access time is *average seek time*, the average amount of time needed to move the sled across the disk's diameter to find the right track.)

The rotation rate also determines the amount of surface area that moves under the optics during any given length of time; it therefore puts a limit on the amount of

data that can be written or read in that time. The rotation rates for the 5.25-inch drives we tested last year were 1,800 to 2,400 rpm. The rotation rates for the 3.5-inch drives in this roundup are 3,000 rpm for the units with a Ricoh or Sony drive mechanism, 2,400 rpm for the MOST-based drive, and a pokey 1,800 rpm for the IBM unit.

OTHER FACTORS

The performance of any MO subsystem depends on more than the drive mecha-

nism. For example, the best performers on our tests were the Acumen and the OCEAN, which use the 2,400-rpm MOST mechanism rather than the faster Sony mechanism. Performance also depends on the package's SCSI host adapter. All other things being equal, a 16-bit card should yield better performance than an 8-bit card. Similarly, a caching SCSI host adapter will yield better performance than an uncached card. All but the Relax package came with a 16-bit noncaching SCSI adapter (the Relax included an 8-bit card), so most were on reasonably equal footing on that score. Acumen should have its

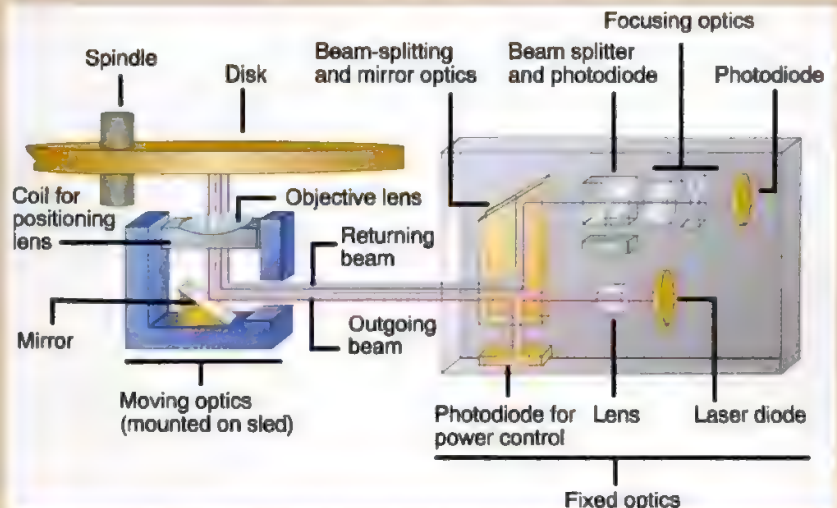
SPLIT OPTICS: Decreasing the Burden, Increasing the Speed

In many ways, the 3.5-inch magneto-optical (MO) drives reviewed here are very similar to the 5.25-inch MO drives we reviewed last year. In both cases, the drives depend on a laser and magnetic field to write to and read from the disk. The difference with this new generation of smaller-format MO drives is the ubiquitous use of split optics; last year, the only 5.25-inch drive we saw that offered this feature was the ASC MO-SS, which used the Maxoptix (Tahiti) mechanism. Only within the last year has Ricoh incorporated the feature into its Hyperspace 5.25-inch MO drive.

Split optics helps to speed average access times by literally taking a load off the sled that moves across the disk to focus the laser on the right track. In traditional 5.25-inch systems, the sled

holds everything from photodiodes to beam-splitting and beam-focusing optics to the relatively massive laser diode. With all this on-board, it is no wonder the sled is slowed down, yielding the slow access times common with 5.25-inch drives.

The new 3.5-inch drives achieve their faster 47- to 77-millisecond access times mainly because of the split-optics design. As shown, most of the optical subsystem (labeled "fixed optics" in the diagram) is stationary rather than on the moving sled. The only things left on the moving sled are a mirror, an objective lens, and a coil for positioning the lens, resulting in a much lighter head and less mass for the sled to move. The diagram shows the laser light path for both the outgoing and returning beams.



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But when you drive a Sony 3.5 inch rewritable optical disk, safety prevails at every turn. Because Sony disks are precisely tuned to perform across all 1800-3600 rpm ISO standard drives.

The fact is, users should pay as much attention to their disk's performance as to the drive's for a very simple reason. Multiple technological differences exist, affecting the way different media behave in various rpm drives.

Which means the media that you select can have a direct impact on how well your drive performs, as well as the reliability of your data.

So whatever speed you're driving, be sure you always fill up on premium. Sony 3.5 inch rewritable optical media.

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CIRCLE 377 ON READER SERVICE CARD

HARDWARE MAGNETO-OPTICAL DRIVES

Syquest is about to
mount a challenge to
these drives with a
105MB removable disk.

Not surprisingly, the combination of faster access times, faster rotation rates, and 16-bit SCSI host adapters yields better performance for these 3.5-inch drives,

compared with the results from last year's 5.25-inch drives. Only the IBM, with a rotation rate and an average access time that match the 5.25-inch drives we tested, has comparably slow performance.

TOO MUCH, TOO LITTLE, TOO SOON

Drive manufacturers such as Ricoh expect the price of 3.5-inch MO drives to drop as economies of scale come into play. But until they do, the 3.5-inch MO drive is still too expensive, too slow, and too lacking in interchangeability to be everyone's answer for high-capacity removable media. If you need only a few removable disks, you are almost certainly better off with Iomega's Bernoulli Transportable 90.



EDITORS' CHOICE

■ OCEAN Vista 128

The eight 128MB 3.5-inch magneto-optical (MO) drive subsystems reviewed here provide an increase in performance over their 5.25-inch cousins, thanks to the combination of speedier access times, faster rotation rates, and the presence of 16-bit SCSI host adapters in most units. That's all a credit to MO technology, but the real competition to 3.5-inch MO systems comes from removable-media options like Iomega's \$1,414 Bernoulli Transportable 90. In that market, 3.5-inch MO drive manufacturers have much to learn about increasing performance and decreasing initial cost before these drives will be widely accepted as near-line storage devices or used in installations where portability or security is important. (On average, external systems cost \$2,300, and internal units are from \$100 to \$300 less.) The predominant lack of interchangeability among vendors' systems will also hurt the 3.5-inch MO drives' chances in the market.

That doesn't mean that there is no call for these products today. You can't slip a Bernoulli cartridge into your shirt pocket, as you can with a 3.5-inch disk; if this is your definition of truly portable media, the 3.5-inch MO disks meet it. And though the purchase price of all these 3.5-inch

drives (when coupled with SCSI host adapters) exceeds the initial cost of a Bernoulli system, 3.5-inch MO disks provide a lower cost-per-megabyte ratio than do Bernoulli cartridges (\$0.50 versus \$1.80 each). Each cartridge also provides nearly 40MB more storage space. If you typically deal with many large and disk-hungry files, the potential savings in media costs may make 3.5-inch MO drives the right choice for you.

Of the subsystems we saw, the OCEAN Vista 128 is the undoubted winner. Using the 2,400-rpm MOST drive mechanism and a Future Domain SCSI host adapter, the Vista 128 provided better performance than any other MO subsystem on PC Magazine Labs' benchmark tests. It swept far ahead of most of the competition on the large-record DOS File Access, Large-File Load, and XCOPY tests. Only the Acumen AcuOptic 128E, also a MOST-based system and also using a Future Domain board, gave it a real run for its money; the Acumen took top scores on the small-record DOS File Access and DOS Disk Access tests, and it fell only a hair's breadth behind on most of the other tests. The Vista 128's performance advantage is matched by its price: At \$2,195, it is one of the more modestly priced units we saw. The Acumen gets an

honorable mention for performance, but at \$800 more than the Vista 128, it can't compete on cost.

The Vista 128 also provides the advantages of automatic installation, software utilities for locking or ejecting the cartridge from the drive, and well-organized and easy-to-use documentation. Keep in mind, however, that MOST-based mechanisms do not support O-ROM (optical read-only memory). Because of the lack of any O-ROM standard, that's not much of a loss today, but it may become a more important issue in the future.

OTHER OPTIONS

If money is no object, the Acumen certainly provides a high level of performance for products of this class. Documentation could be better, but the product is fully DOS compatible, and installation is simple.

Perhaps some of the best advice we can give to anyone studying this market is this: Carefully consider whether a 3.5-inch MO drive is the best choice for your applications. If the low cost per megabyte offered by 3.5-inch MO drives is not important to you, and you need to expand your primary storage, add secondary storage, or secure your data, removable hard disks or Bernoulli cartridges may be better choices.

HARDWARE MAGNETO-OPTICAL DRIVES

Syquest is about to mount an even tougher challenge to MO drives (and the Bernoulli drive, for that matter) with a 105MB removable Winchester disk that should be available this fall. The drive, which Syquest says will fit in a 3.5-inch bay, will have an average access time of 23 ms. and a rotation rate of 3,600 rpm. Syquest was unable to provide projected list prices for the drive but expects the street price to be under \$1,000 with one removable cartridge. Additional cartridges will be under \$100 each, street price.

For now, MO drives remain an appropriate solution for a relatively few applications. But the laser light at the end of the tunnel may be in sight. If the industry achieves agreement on a standard that allows full interchangeability, and prices do indeed fall, there is a strong likelihood of much wider applicability for this technology within the next two years or so. And rewritable optical drives for the mainstream desktop may yet become a

reality with even the current crop of 3.5-inch drive mechanisms.

ACUMEN COMPUTER SYSTEMS INC.

Acumen AcuOptic 128E

by John R. Quain

Aggressive coaches are fond of reminding their players that good may not be good enough to win. When compared with other magneto-optical (MO) drives in this roundup, the Acumen AcuOptic 128E may give customers the same impression. Though the external 128MB 3.5-inch drive is quick and performs flawlessly, its \$2,995 price makes it one of this group's most expensive systems.

Based on the 2,400-rpm MOST RMD-5100S drive mechanism from Nakamichi Peripherals Corp., the company bundles



Acumen AcuOptic 128E

Acumen Computer Systems Inc., 1887 Business Center Dr., #4A, San Bernardino, CA 92408; 800-876-0486, 714-386-7737.

List Price: External drive with SCSI host adapter, cable, and one cartridge, \$2,995.

Requires: DOS 3.0 or later.

In Short: The second-fastest drive reviewed, the Acumen AcuOptic 128E is a good choice and operates cleanly as a standard DOS device. Its documentation could be more thorough, but its only real drawback is a hefty price tag.

CIRCLE 475 ON READER SERVICE CARD

TECHNOLOGY OUTLOOK: 5.25-Inch Rewritable Optical Drives

Maybe 3.5-inch rewritable MO drives aren't for you. Here is an overview of where 5.25-inch MO drives are going.

by Nick Stam

With 3.5-inch magneto-optical (MO) drives aimed at single users or entry-level networks, those of you with larger storage needs may be wondering where the 5.25-inch MO market is heading. Basically, MO is still overwhelmingly the rewritable technology of choice, but phase change drives offered by Corel, Panasonic, and Reflection Systems are beginning to have an impact. Dye polymer drives, which have been consistently plagued by difficulties and consequently languishing in development labs for years, are no longer considered a viable rewritable technology.

MO: STILL POPULAR

Though the MO drives you can buy today are competitive products, don't think that the technology has leveled off. One near-term technological development in the MO arena includes a proposed ISO/ANSI (International Standards Organization/American National

Standards Institute) 2X standard that will double existing data storage capacities.

All of the reviewed 3.5-inch MO drive subsystems and most of their 5.25-inch counterparts use standard ISO-compatible continuous composite servo (CCS) MO media formats. (*Continuous composite servo* means that each data track on the media must be sandwiched between two tracking grooves. The laser beam is then split into three beams, one for reading and writing data at varied power levels and two for tracking within the grooves and focusing the center beam.) Pioneer, however, is implementing a sampled-servo capability in its DE-7001 multifunction 5.25-inch drive. (*Sampled-servo* media contain tracking and focusing information in each data track, eliminating the need for tracking grooves or splitting the laser beam. Also, sampled-servo formats can theoretically pack more tracks of data on a disk.) Until recently, sampled-servo has traditionally been used in WORM (write once, read many) systems.

The heaviest weight dragging down MO performance is the two-pass write system presently employed by most drives. Using a magnetic modulation

technique, 5.25-inch MO drive developers in the labs will eventually clear this hurdle by quickly modulating the bias magnet, keeping it in step with the laser as the latter zaps the media's recording surface. Effectively, this method does away with the present-day erase pass. Drives based on this technology should arrive late in 1992.

Another currently researched technique quickly modulates the laser and uses multiple active recording layers on the media to permit single-pass writes. (For an in-depth discussion of laser-modulation recording techniques, see the sidebar "Seeking a Faster Drive: Up-and-Coming Rewritable Optical Technologies" in our June 11, 1991, article on 5.25-inch MO drives.) No announcement dates for drives based on this technique have yet been specified.

THE PHASING OF PHASE CHANGE

Currently, the most intriguing and controversial rewritable technology is phase change. Laser beams at varied power levels alter phase change media between a reflective crystalline state and a nonreflective amorphous state. Data is encoded as a series of reflective changes

CONTINUES

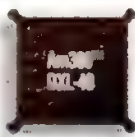


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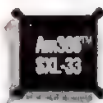
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HARDWARE

MAGNETO-OPTICAL DRIVES

the Acumen with one blank cartridge; cabling; software; and a 16-bit Future Domain SCSI adapter card, which comes with a 64K look-ahead buffer and hard disk and floppy disk drive connections. Additional formatted cartridges are a rather pricey \$130 each. An internal version of the Acumen that fits in a 5.25-inch drive bay is available for \$200 less. You will need DOS 3.0 or later for either version.

As with a typical hard disk, we used DOS's FDISK command to low-level-format the Acumen's cartridge. When we removed the cartridges and issued commands, the Acumen behaved like a standard floppy disk drive, eliciting the standard error messages without any of the system hangs that plagued some of the first-generation 5.25-inch MO drives. The system will also boot up with or without a cartridge installed, and you can select the Acumen as the boot drive.

Software installation is a simple proce-

The Acumen's laudable performance was nearly indistinguishable from that of the first-place OCEAN Vista 128.

duce: Add one command line to the CONFIG.SYS file and copy the company's device driver to the boot drive's root directory. It is not the most elegant installation approach, and the supplied documentation could be more thorough. But the software driver uses less than 4K of memory and ran PC Magazine Labs' per-

formance tests without any conflicts. The only jumper settings we needed to adjust were those that disable the SCSI adapter's floppy disk controller.

EXCELLENT PERFORMANCE

The Acumen's laudable performance was nearly indistinguishable from that of the first-place OCEAN Vista 128, falling behind only on the XCOPY from Winchester to Magneto-Optical test, where it required 28 minutes 40 seconds. When loading a 25MB TIFF graphics file, the Acumen (at 5 minutes 10 seconds) was just 3 seconds behind the OCEAN, with the next-fastest MO drive lagging by nearly a minute and a half. Turning in a time of 11 minutes 18 seconds on the XCOPY from Magneto-Optical to Winchester test, the Acumen was once again the second-fastest MO drive—just behind the OCEAN Vista 128 but minutes ahead of the majority.

To increase throughput, the company

TECHNOLOGY OUTLOOK: 5.25-Inch Rewritable Optical Drives

CONTINUED

on a track—and this is done in only one pass. Although the drive uses different laser-beam power levels, it uses a single-beam system in combination with optical sensors to read and write data, track, and focus. The key advantage of phase change over MO continues to be one-pass writing, although as mentioned earlier, future MO designs will reportedly nullify this edge.

Though there are no 3.5-inch phase change drives available yet, Corel, Panasonic, Reflection Systems, and others all market 5.25-inch multifunction phase change drives. These use phase change media developed by Matsushita. There are no ISO format standards yet for phase change drives, and this will hamper market acceptance for a while.

FUTURE OPTICAL OPTIONS: TO BOLDLY GO...

All drive and media vendors are striving toward higher data density, longer media life, increased read/write speeds and *cyclability* (the number of times a disk can be read from and written to before degrading), and more reliable subsystems.

At an unspecified future date, Sony

may present a technique it has dubbed IRISTER (IRIS Thermal Eclipse Reading). The IRISTER system isolates and reads the highest-temperature spot of a laser-hit microscopic area on the media surface. This procedure allows a reduction of surface area for each stored bit of information. Sony claims that this method can create up to a sixfold storage density increase. If a shorter-wavelength blue laser can be developed, then the IRISTER approach might increase storage by a factor of 20.

The most elegant new technique currently in design labs uses a principle called *electron trapping*. If an electron is accelerated to a higher energy level and then falls to a less excited state, a fixed amount of energy equaling the difference between the higher and lower states is released as radiation (photons or light energy). This energy is of a specific frequency and wavelength. If the electrons can be accelerated to the higher levels and then "trapped" for future access, it is possible to store data. A binary 1 may be determined by detecting the light energy released when selectively forcing trapped electrons to their lower energy levels. Some experi-

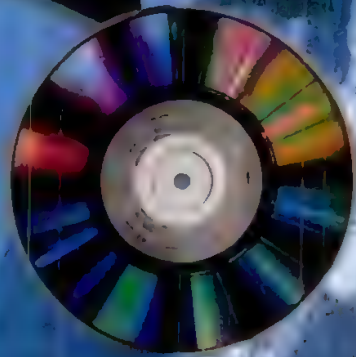
ments use laser light to raise electrons into the traps and infrared radiation to bounce them out.

A laser with a specified wavelength is used to accelerate electrons to a particular energy level. But it is feasible to use lasers of varying wavelengths in conjunction with multilayered media that respond to the different lasers to store multiple data bits at the same spot. Because only the electrons move and the media's surface magnetism is not altered (as with MO media) nor its atomic structure changed (as with phase change), endless read/write cycles and much faster writing times are possible.

Don't expect to see optical drives based on electron trapping any time soon, though. Development obstacles include instability of the electron traps and the external light isolation. Today, researchers are unable to keep the electrons in their traps for long periods of time; an indefinite trap life is mandatory if electron trapping is to be considered viable. Another major design problem is the need for a totally sealed chamber devoid of any extraneous light, since light could prematurely or undesirably jolt electrons out of their traps. ■

THE PINNACLE.

TYPE: 3.5" OPTICAL
CAPACITY: 128 MB
SIZE: 6.75"(H) x 2.125"(W) x 8.25"(L)
MOUNTING: VERTICAL OR HORIZONTAL



The Pinnacle. The top. The leader in optical storage. Since 1988, Pinnacle's been the world's leader in optical storage solutions, shipping more systems than any other company.

Introducing the Pinnacle Micro REO-130S rewritable optical drive featuring the new Sony 3.5" mechanism. With its 38 msec access time, the REO-130S is the perfect storage solution for personal computing, desktop publishing, multimedia, data distribution and backup.

Company	Avg. Price	Per Disk Capacity	Price Per 5 Disks	Capacity of 5 Disks	Before Price
Pinnacle Micro REO-130S	\$ 79	128 MB	\$ 395	640 MB	\$1995
Imaging Bernoulli® 90	229	90 MB	1145	450 MB	1149
Syquest™ (PI) 88	229	88 MB	1190	440 MB	1199

Pricing advantage over Bernoulli® and Syquest™. Pinnacle's REO-130S offers a lower cost per megabyte compared to its magnetic storage competition. Users now need fewer disks while getting more storage capacity at a lower price.

Optical Technology has distinct advantages over the Bernoulli® and Syquest™ technology. Since optical drives use laser technology to store information there is no chance of head crashes. 3.5" optical has a much smaller footprint than 5.25" magnetic but holds 40% more data.

Reliability of optical media is 15 years (shelf life) - that's 3 times longer than Bernoulli® and Syquest™ magnetic disks. Since the 3.5" cartridges are removable, optical remains the most secure way of storing your data into the future.

Media Standards for 3.5" optical disks have both ISO and ANSI standards to support the technology, while Bernoulli® and Syquest™ have none. Each 3.5" disk can be recognized in any 3.5" ISO/ANSI standard optical drive.

The Pinnacle Advantage is clear. Pinnacle Micro dominates the optical storage industry by offering the largest selection of 3.5" and 5.25" optical drives and disk changers. Interface kits are available for MAC, SUN, DEC, IBM and compatibles. The Pinnacle. Your next storage system.

*Estimated. Dealers: REO-130S of Pinnacle Micro, Inc. © 1991 of Pinnacle Micro, Inc. Support of Syquest Corp. Registered Owners: Bernoulli of Imaging. Pricing indicated details from manufacturers as of 11/1/91

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PINNACLE MICRO

THE OPTICAL STORAGE COMPANY™

CIRCLE 230 ON READER SERVICE CARD

The IBM PS/2 3.5-Inch Optical Rewritable's technical limitations mean that it is slower than the other drives reviewed here.

offers a cached Acumen SCSI adapter, the AcuCache 1200, for \$895 with 512K (expandable to 16MB). But Acumen Computer Systems was unable to supply the product in time for PC Labs' tests. EISA and PS/2 MCA adapters are also available for an additional \$399 each. And network managers can pay \$199 to receive support for Novell's *NerWare* or Microsoft *Manager* networks. Acumen equipment is covered by a one-year warranty on parts and labor, and the company operates a toll-free technical support line—weekdays from 8:00 to 6:00 P.S.T.—as well as a BBS for users.

The question customers face with the Acumen is whether or not the drive's excellent performance can make up for its high price tag. Several close competitors are around \$1,000 less; the OCEAN, for instance, costs \$800 less than the Acumen and performs slightly better. The Acumen AcuOptic 128E is a good choice but an expensive one.

IBM CORP.

IBM PS/2 3.5-Inch Optical Rewritable Drive

by John R. Quain

As the first PC manufacturer to offer a 3.5-inch MO drive for its own systems, IBM's presence gave other MO manufacturers encouragement that a popular new storage standard would arise. That may still happen, but if performance tests are any indication, it won't be based on IBM's technology.

With dealer discounts of 20 percent, the external IBM PS/2 3.5-Inch Optical Rewritable Drive is competitively priced

at \$2,155. PS/2 owners can connect the IBM to their existing 16-bit or 32-bit SCSI-2 controllers. But if you need it, the company offers its own \$495 full-length 16-bit PS/2 MCA SCSI-2 adapter with a 64K look-ahead buffer (which we used for our tests). Cabling is an additional \$220. Single unformatted 128MB cartridges are \$70 each, bringing the cost of our tested configuration to a con-

siderably costlier \$2,940.

A 32-bit caching controller, which we did not receive in time for this product review, is available for \$995. IBM does not, however, offer any SCSI host adapters for the AT bus.

IBM's MO drive is one of only two drives we tested that behaved like a large floppy disk rather than a removable hard disk. Formatted like floppy disks, the IBM cartridges do not have partition tables and cannot be used as the boot disk.



SUMMARY OF FEATURES

Products listed in alphabetical order by company name

☐ Editors' Choice ☒ Yes ☐ No		Acumen AcuOptic 128E	IBM PS/2 3.5-Inch Optical Rewritable Drive
List price (tested configuration)		\$2,995	\$2,940
PHYSICAL CHARACTERISTICS			
Dimensions (HWD, in inches)		1.6 x 5.8 x 8	3.3 x 9.5 x 11.2
Weight (pounds)		8	8.5
Mechanism		MOST RMD-5100S	IBM MD-3125A
Look-ahead buffer		128K	64K
SCSI host adapter (tested configuration)		Future Domain TMC-1680	IBM P/N 6451109
Look-ahead buffer size		64K	64K
SCSI chip set		Future Domain 1680	IBM
Interface		16-bit	16-bit
Size of adapter		Half-length	Full-length
Available options		ISA 8-bit, EISA, MCA	None
MEDIA			
Media ejection		Manual, automatic	Manual
Media can be partitioned as multiple volumes		☒	☐
Maximum partition size		128MB	127.1MB
RATED SPECIFICATIONS			
Disk rotation speed (rpm)		2,400	1,800
Burst transfer rate		1.5MB/second	4MB/second
Average seek time (milliseconds)		35	60
Average latency (milliseconds)		12	17
Average access time (milliseconds)		47	77
SERVER OPERATING SYSTEMS SUPPORTED			
NetWare		Versions 2.1.5, 3.1 (\$199 each)	Version 3.11 (included)
VINES		None	None
LAN Manager		Version 1.0 (\$199)	None
AppleShare		None	None
Unix		Versions 2.x, 3.x (\$299 each)	None
MISCELLANEOUS			
DOS device driver size		3K	10K
Power consumption (watts)		13.4 (read), 29.8 (write)	23
Price of internal version		\$2,795	\$2,085
Bay size and height		5.25-inch, half-height	3.5-inch, half-height

N/A—Not applicable: The product does not have this feature.

*These questions do not apply to the Trantor T338 MiniSCSI adapter, which plugs into the parallel port.

HARDWARE

MAGNETO-OPTICAL DRIVES

TECHNICAL LIMITS =

SLOWER PERFORMANCE

The IBM's technical limitations mean that it is slower than the other drives reviewed here. The drive mechanism spins at only 1,800 rpm, and its average access time is rated at 77 milliseconds. Our performance tests underlined these technical differences.

Because of its MCA SCSI host adapter, we had to test the IBM on a 25-MHz IBM PS/2 Model 80, rather than our standard

Compaq Deskpro 386/25e test-bed. On every test, this drive trailed the others (except the Relax Sierra Optical 128, when using its Trantor T338 MiniSCSI parallel-port adapter). On the small-record DOS File Access test, the IBM delivered less than half the throughput of the fastest drives (31.19 kilobytes per second versus the Acumen AcuOptic 128E's 79.34 Kbps and the OCEAN Vista 128's 76.65 Kbps).

Storing PC Magazine Labs' 25MB test graphics file required patience: The IBM took nearly 10 minutes to complete the task. Partly because of the Model 80's slower disk subsystem and partly because the IBM may impose verification by using a less efficient algorithm when writing to disk, writing information to the drive emphasized the speed differences. A hard disk backup took over 50 minutes when most of the other MO drives accomplished the task in under 30 minutes.

MicroNet MO-128/DOS	OCEAN Vista 128	Peripheral Land Inc. (PLI) Infinity Optical 3.5-Inch	Pinnacle Micro REO-130S	Procom MEOD128	Relax Sierra Optical 128
\$2,241	\$2,195	\$2,099	\$2,274	\$2,344	\$1,479†; \$1,579†
2.8 x 10 x 10.4 8	2.5 x 9.7 x 10.8 8	2.5 x 10 x 10 5.6	7 x 8.5 x 22.5 5.3	2 x 8.5 x 9.5 6.2	5 x 2 x 8 3.4
Sony SMO-P301 64K MicroNet HA-01	MOST RMD-5100S 128K Future Domain 1660	Sony SMO-P301 64K PLI PC QuickSCSI	Sony SMO-P301 64K 10Times TNT-4050	Sony SMO-P301 64K Procom CC-16 SCSI Enabler	Ricoh RO-3010E 128K Trantor T128; Trantor T338 MiniSCSI
N/A NCR 53C94	N/A Future Domain 1660	8K Future Domain TMC-1800	64K Western Digital WD33C93A-SBIC	8K NCR 53C90A	N/A National Semiconductor 5380
16-bit Half-length	16-bit Half-length	16-bit Half-length	16-bit Full-length	16-bit Half-length	8-bit (Trantor T128) * Half-length (Trantor T128) * EISA, ISA 16-bit, MCA
EISA 8-bit, MCA, Mac	ISA 8-bit, MCA, Mac	ISA 8-bit	MCA, Mac, Sun	ISA 8-bit, MCA	
Manual ■	Manual, automatic ■	Automatic ■	Manual ■	Manual, automatic ■	Manual □
128MB	121MB	128MB	128MB	128MB	128MB
3,000 10MB/second 40 10 50	2,400 3MB/second 35 12 47	3,000 4MB/second 40 10 50	3,000 3MB/second 40 10 50	3,000 4MB/second 40 10 50	3,000 4MB/second 33 10 43
Versions 2.1x, 3.xx (\$199 each) Version 4.0 None None	Version 3.11 (\$300) None None Version 2.01 (included) None	NetWare 286 or 386 (included) None None None	Version 3.1x (included) None None Version 2.0 (included) Version 4.1.1 (included)	Versions 2.x, 3.x (included) None None None	Versions 2.x, 3.x (included) None None Versions 2.x, 3.x (included) None
SCO Unix (included)		SCO Unix (included)		SCO Unix (included)	
8K 13.8	4K 18	13K 13.8	3K 57.5	8K 19 (read), 35 (write)	14K 9.5
N/A N/A	\$1,895 5.25-inch, half-height	\$1,999 3.5-inch, half-height	\$1,995 3.5-inch, half-height	N/A N/A	\$1,299 3.5-inch, half-height

† Price with Trantor T128 adapter.

‡ Price with Trantor T338 MiniSCSI adapter.

PERFORMANCE TESTS

The MOST-based drives from OCEAN and Acumen provide the best performance among these eight MO drives, but even they can't outperform a Bernoulli Transportable 90.

HOW WE TESTED

Most of the 3.5-inch external magneto-optical drives were tested on a Compaq Deskpro 386/25e, which was running Compaq DOS 5.0 and equipped with 8MB of memory and a 310MB ESDI hard disk partitioned into two logical drives of 155MB each. For the IBM unit, which includes a Micro Channel SCSI host adapter, our test-bed was a 25-MHz IBM PS/2 Model 80 running DOS 5.0 and equipped with 8MB of memory and a 320MB SCSI hard disk partitioned into two logical drives of 160MB each. In all cases, the magneto-optical drives used disks formatted with 512-byte sectors.

For the XCOPY tests, we created a 119MB directory structure on the hard disk and used the DOS XCOPY command (with the /S switch set in order to copy all subdirectories) to copy the data from the hard disk to the MO disk and back. The size of this directory amounted to 98.3 percent of the formatted MO disk's size; the procedure we used fully extends the read/write head.

For all our tests, we used Iomega's 90MB Bernoulli Transportable 90 drive as a standard of comparison. For the XCOPY tests using the Bernoulli drive, we used an 88.4MB directory structure to arrive at the same 98.3 percent capacity; both directory trees maintained the same level structures. We also used the Compaq computer's hard disk as a reference point, but there are no XCOPY test results for the Compaq hard disk because it acted as the control drive for these tests.

For each test, we report two results for the Relax system, as we tested it both with its standard SCSI host adapter (the Trantor T128) and with its MiniSCSI parallel-port adapter (the Trantor T338 MiniSCSI).

For the Sequential Throughput tests,

we report results only for the IBM and Relax drives. The MOST drive mechanism, which is used by the Acumen and OCEAN products, does not support O-ROM. The drivers provided by the vendors using the Sony drive in their subsystems (MicroNet, Peripheral Land, Pinnacle, and Procom) do not support the same logical format as the IBM and Relax drivers, which were compatible with the O-ROM media used in our

On the DOS File Access tests, the MOST-based drives from Acumen and OCEAN outperformed the others by a comfortable margin.

tests. For this test, the O-ROM disk was provided by Sony.

Neither the Bernoulli nor the Relax unit could perform our DOS Disk Access test, because neither unit supports interrupt 13h, which this test requires.

WHAT THE NUMBERS MEAN

The small- and large-record DOS File Access tests are the two most significant tests we performed for this analysis. Because these tests involve file creations, reads, and writes for small records (database-like files) and large records (program-like files), the tests provide an insight into the magneto-optical drive's ability to transfer information.

On the DOS File Access tests, the MOST-based drives from Acumen Computer Systems and OCEAN Microsystems outperformed the other drives by a comfortable margin, turning in nearly identical results. On the DOS Disk Access test, which indicates a drive's rotational speed and head stepping time, these two units again provided the best results among the MO drives tested.

The XCOPY tests simulate a standard backup scenario. In general, MO drives require two passes of the read/write head to write data. Among the MO drives on this test, the OCEAN system came out on top, moving our 119MB directory tree from the hard disk to the MO drive in 25 minutes 43 seconds. Following closely behind was the Pinnacle unit.

The IBM system's results for the XCOPY from Winchester to MO Drive test were disappointing, partly because of the Model 80's slower disk subsystem and the IBM MO drive's slower rotational speed. It is also possible that IBM employs a less efficient algorithm for verification in firmware than the others when writing to disk, although the company could not confirm that. That would explain why its XCOPY from MO Drive to Winchester test time (where verification would not be a factor) was more in line with the competition, though still a poor score.

One of the uses for these MO drives is near-line storage—the storage of files you need to access on a regular but not frequent basis. Typically these are larger files that you don't want taking up hard disk space. The Large-File Load test indicates the drive's performance in handling a 25MB image file. If you use the file-swapping facility in Microsoft Windows, a file of this size must be loaded piecemeal, no matter what the storage medium. Once again, the OCEAN and Acumen drives led the MO pack at 5 minutes 7 seconds and 5 minutes 10 seconds, respectively.

While the Bernoulli drive outperformed the MO drives in all other instances, here it returned a surprisingly slow time of 5 minutes 55 seconds. This can probably be attributed to the file-handling techniques employed in Windows (although Iomega could not confirm this). These test results indicate that with files of this size, the application software and operating environment, rather than the drive mechanism, are the limiting factors. Because of the way Windows operates, you don't get the advantage from the Bernoulli drive that you would expect from its through-

HARDWARE

MAGNETO-OPTICAL DRIVES

put scores on the DOS File Access tests.

Not surprising was the slow performance the Relax unit exhibited when used with its MiniSCSI parallel-port adapter; the limits imposed by the parallel port are responsible. For example, the timing on the Large-File Load test was the worst we saw. The company explained that Windows constantly polls the parallel port for printer operations in Enhanced mode, so the adapter's performance suffers markedly. When we

ran Windows in Standard mode, the product achieved a time of 6 minutes 49 seconds, which is more in line with what the competition achieved with Windows running in Enhanced mode.

In comparison with the MO drives, the Bernoulli drive's performance, particularly on the XCOPY from Winchester to MO Drive test, was striking. Part of this is because the Bernoulli requires only one pass of the read/write head to write data. Also remember that because

of the Bernoulli drive's lesser 90MB capacity, the total amount of data moved was 26 percent less than with the MO drives, which could also be a factor.

On the Sequential Throughput tests, the Ricoh-based Relax drive with its standard SCSI adapter installed was the clear winner over the IBM system; it achieved a throughput of 351K per second for the 2MB file and 352K per second for the 10MB file.



MAGNETO-OPTICAL DRIVE TESTS

Higher scores represent better performance.

Lower scores represent better performance.

	DOS File Access (Small Records) (kilobytes/second)	DOS File Access (Large Records) (kilobytes/second)	DOS Disk Access (milliseconds)	XCOPY from Winchester to MO Drive (minutes:seconds)	XCOPY from MO Drive to Winchester (minutes:seconds)	Large-File Load (minutes:seconds)
* Compaq Deskpro 386/25e hard disk	231.91	698.31	15.78	N/A	N/A	4:43
* Bernoulli Transportable 90	102.97	423.38	N/A	9:44	7:06	5:55
Acumen AcuOptic 128E	79.34	239.23	36.67	28:40	11:18	5:10
OCEAN Vista 128	76.65	239.42	36.69	25:43	11:09	5:07
Pinnacle Micro REO-130S	61.57	212.77	53.24	26:14	13:10	7:31
MicroNet MO-128/DOS	54.56	225.48	50.34	26:37	12:30	6:51
PLI Infinity Optical 3.5-Inch	54.53	221.25	47.92	28:47	13:41	7:28
Relax Sierra Optical 128 (with Trantor T128 adapter)	50.77	222.09	N/A	31:39	11:35	6:38
Procom MEOD128	39.66	198.68	54.86	29:24	13:49	9:16
IBM PS/2 3.5-Inch Optical Rewritable Drive	31.19	137.98	56.62	53:57	17:49	9:59
Relax Sierra Optical 128 (with Trantor T338 MiniSCSI adapter)	27.52	63.32	N/A	40:27	29:49	54:29

* Reported for comparison. N/A—Not applicable: The product could not perform this test.

Higher scores represent better performance.

Sequential Throughput	2MB File (kilobytes/second)	10MB File (kilobytes/second)
Relax Sierra Optical 128 (with Trantor T128 adapter)	351	352
IBM PS/2 3.5-Inch Optical Rewritable Drive	211	212
Relax Sierra Optical 128 (with Trantor T338 MiniSCSI adapter)	87	88

The **DOS File Access (Small Records)** benchmark test measures disk throughput as a result of mechanical MO drive speed, SCSI interface functions, and bus speed. This test measures how well the drive can create, write, and read (both sequentially and randomly) a 256K file using 512 records of 512 bytes and 64 records of 4 kilobytes. The test is performed without software disk caching.

The **DOS File Access (Large Records)** benchmark test is the same as the small-record test except that the 256K file now uses 16 records of 16K and 8 records of 32K.

The **DOS Disk Access** benchmark test measures the total time required to perform 1,000 read requests at random locations on the MO

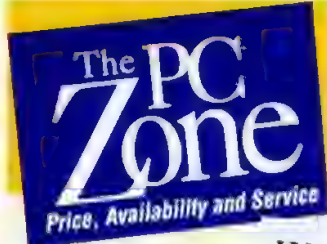
disk using DOS interrupt 25h. This test should work with any device that DOS recognizes as a disk.

The **XCOPY from Winchester to MO Drive** benchmark test, which uses the XCOPY command with the /S switch, records the time required to copy a 119MB file system from the hard disk to a formatted blank MO disk. This procedure can be used when archiving data from the hard disk to the MO.

The **XCOPY from MO Drive to Winchester** benchmark test, which uses the XCOPY command with the /S switch, records the time required to copy a 119MB file system from the MO disk to an empty hard disk.

The **Large-File Load** performance test measures the time required to load a 25MB full-color TIFF file into a graphics application (in this case, Aldus Corp.'s *PhotoStyler*) from the MO disk.

The **Sequential Throughput** performance tests are calculated by measuring the average time required to read 16-kilobit blocks from a 2MB file and a 10MB file, respectively. The sequential throughput reflects the drive's performance during such operations as loading programs and large data files from O-ROM media.



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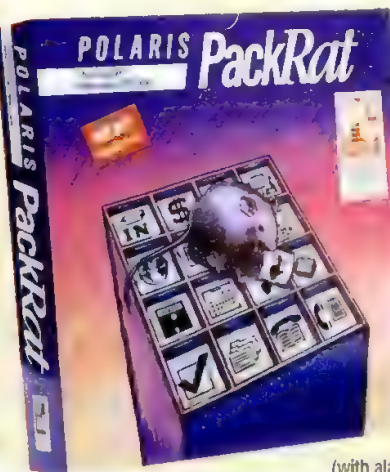
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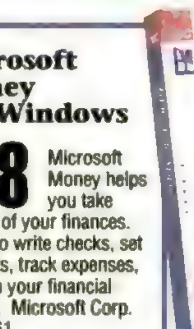
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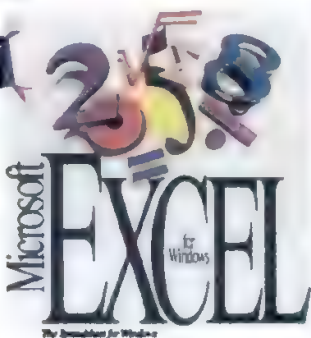
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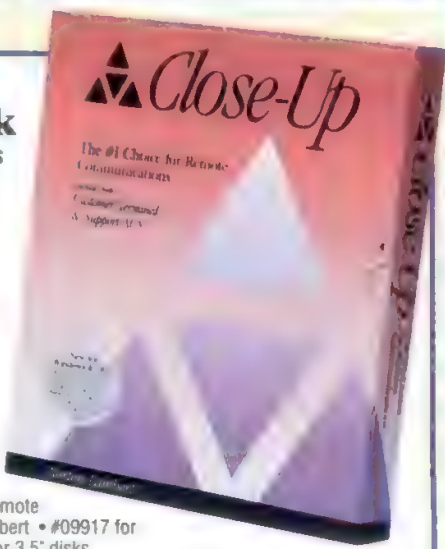
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MAGNETO-OPTICAL DRIVES



IBM PS/2 3.5-Inch Optical Rewritable Drive
IBM Corp., Old Orchard Rd., Armonk, NY
10605; 303-924-4100.

List Price: External drive with SCSI host adapter, cable, and one cartridge, \$2,940.

Requires: DOS 4.0 or later, or OS/2 1.3 or later.

In Short: The IBM PS/2 3.5-Inch Optical Rewritable Drive was one of only two drives that formatted like a floppy disk rather than a hard disk. The cost is midrange if you don't need the MCA SCSI host adapter, but with it the complete system we reviewed has one of the highest prices we saw. All in all, this drive fails to measure up to the performance of its competitors. Its performance shortcomings will attract few followers.

CIRCLE 476 ON READER SERVICE CARD

Only the IBM and Relax systems, which both use the IBM logical format, were capable of reading the O-ROM (optical read-only memory) cartridge Sony supplied for our Sequential Throughput tests. On these tests, the Relax unit when paired with its standard internal SCSI adapter outpaced the IBM by a comfortable margin. The IBM will not handle disks that are partially rewritable and partially O-ROM.

If the poor performance does not dissuade you from considering the IBM, you will find the rest of the package more than satisfactory. Installation is conducted by following a helpful automatic software install utility. (The DOS device driver uses over 10K of RAM, however.) The only hardware manipulation you will need is the removal of a PROM terminator on the SCSI card when more than one device is connected.

When you first use a blank cartridge, the DOS format command will begin a low-level format; use the quick /Q switch for subsequent formats. The IBM works with DOS 4.0 or later and OS/2, Version 1.3 or later. The company also includes a simple utility that uses a menu interface for backup and restore tasks.

For users who don't want additional peripherals cluttering their desks, the company offers an internal model for \$1,795

(the SCSI adapter and cartridges are extra). It is compact enough to fit inside a 5.25- or 3.5-inch PS/2 bay on most systems. The 3.5-inch bays in the Models 50, 55, and 70, however, are configured for a floppy disk connector only, so you must use the external model with those systems.

The product has a one-year parts-and-labor warranty, and technical support is available via an 800 number seven days a week from 6:00 A.M. to 3:00 A.M. E.S.T.

In the end, the IBM PS/2 3.5-Inch Optical Rewritable Drive fails to measure up to the state of the art. Users are best advised to look to others in this roundup for better performance.

MICRONET TECHNOLOGY INC.

MicroNet MO-128/DOS

by John R. Quain

If superior performance is what you crave, the \$2,241 MicroNet MO-128/DOS won't satisfy you. Compared with others, the MicroNet offers only midrange performance at a midrange price, though MicroNet Technology offers a respectable assortment of options for different operating and network environments.

Based on the 3,000-rpm Sony SMO-P301 3.5-inch drive mechanism, the standard MicroNet package includes cabling, software utilities, one cartridge, and MicroNet's own 16-bit ISA SCSI-2 host adapter. Additional blank formatted cartridges cost \$59 each or \$500 for a package of ten.

As with most of the other drives in this issue, a button on the back of the MicroNet allows you to select the SCSI address. The host adapter includes a floppy disk drive controller and internal SCSI connection but no look-ahead buffer.

Aside from changing a jumper setting to disable the adapter's floppy disk controller, hardware installation revealed no peculiarities. Software installation is conducted by means of a simple utility, and the device driver uses approximately 4K of RAM. MicroNet's manual is designed for use with its various MO storage devices and therefore lacks the sort of specificity and description needed by first-time users.

As with some other MO devices in this group, the only operating snag we discov-

ered was that the MicroNet's cartridges could not use DOS's FDISK format command. The company supplied a utility to low-level-format and partition cartridges, however, and it worked smoothly. In all other respects, the MicroNet had no difficulty with standard DOS instructions.

MODEST PERFORMANCE

Complementing its midrange price, the MicroNet yielded modest test results on PC Magazine Labs' performance tests. Its DOS Disk Access time of 50.34 milliseconds was average for this group. The MicroNet's small-record DOS File Access test result—54.56 kilobytes per second—was midrange as well, but it proved more competitive on our hard disk backup test, where it accomplished the task in 26 minutes 37 seconds. It moved back into the midrange with its hard disk restore time of 12 minutes 30 seconds. This combination of test results suggests the MicroNet is more adept at writing to disks and thus better suited to backup and archival duties, rather than near-line or more regular storage.

A reliable backup application, called *ARCserve/Solo*, is available for \$99. It handily performs backups at selected times, as well as logging and tracking duties. The company has a welcome variety of options for different operating and network environments. For an additional \$99, MicroNet supplies Novell support for *NetWare 2.1x* and later. *VINES* and *SCO Unix* compatibility is included. Complete *EISA* and *MCA MicroNet* drive



MicroNet MO-128/DOS

MicroNet Technology Inc., 20 Mason, Irvine, CA 92718; 714-837-6033.

List Price: External drive with SCSI host adapter, cable, and one cartridge, \$2,241.

Requires: DOS 3.1 or later.

In Short: An average performer with an average price, the MicroNet MO-128/DOS's only distinguishing feature is well-rounded network support.

CIRCLE 477 ON READER SERVICE CARD

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PC Magazine, Oct. 29, 1991

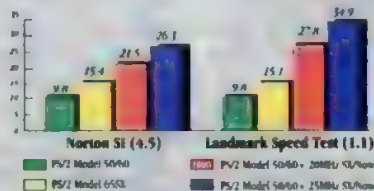
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PC Week, Aug. 26, 1991

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kits are also offered for \$2,470 and \$2,380, respectively. Technical support for all of these products is available weekdays from 7:30 to 5:30 P.S.T., but it requires a toll call. The company also operates a BBS. The MicroNet comes with a one-year warranty.

The company does not offer an internal drive or caching SCSI adapter yet, but the MicroNet provides steady though not rapid performance. Storage-hungry shoppers won't go wrong by choosing the MicroNet MO-128/DOS, but there are better performers available for less money.

OCEAN MICROSYSTEMS INC.

OCEAN Vista 128

by John R. Quain

Of the eight drives reviewed here, it is the OCEAN Vista 128 that rises to the top of the class, combining leading performance with an attractive price.

Priced at \$2,195, the OCEAN includes all necessary cabling, a 16-bit ISA SCSI-2 host adapter, software utilities, and one cartridge. An internal version is available for \$1,895 but requires a 5.25-inch drive bay. Additional blank unformatted MO cartridges from OCEAN Microsystems are \$69 each. The supplied *Compass* 2.9 software includes an installation program; formatting utilities; and lock, unlock, and

cartridge-eject software controls.

Devoted solely to optical storage products, OCEAN is a wholly owned subsidiary of Nakamichi Peripherals Corp. (which makes the 2,400-rpm MOST RMD-5100S drive). Naturally, the OCEAN uses this drive. In its standard configuration, the OCEAN is similar to the more expensive \$2,995 Acumen AcuOptic 128E that we also reviewed. Both peripherals use the MOST drive and employ a half-length Future Domain SCSI-2 adapter, although the OCEAN's adapter does not sport a floppy disk controller, nor does it include a look-ahead buffer.

PERFORMANCE WINNER

The OCEAN was generally the front-runner on PC Magazine Labs' performance tests, followed closely by the Acumen; only on the XCOPY from Winchester to Magneto-Optical test was there a significant margin between them (25 minutes 43 seconds versus 28 minutes 40 seconds). Both these drives bested their MO competitors on the small-record DOS File Access test, with the OCEAN scoring 76.65 kilobytes per second and the Acumen turning in 79.34 Kbps. If you are looking for an MO drive for database or archival storage, these two drives appear to be superior choices.

Using OCEAN's automatic installation program, software setup was relatively painless, though we encountered a conflict between the OCEAN driver and Compaq BIOS. We resolved the conflict by using an undocumented software switch, but it meant we had to use the *Compass* format utility rather than DOS's FDISK command to perform a low-level format. The company's software driver requires only 4K of RAM. The supplied user manuals are well organized and simple enough for novices to follow.

If you are shopping for removable storage for a file server, OCEAN offers *NetWare*, Version 3.11, support for an additional \$300. You can also purchase a \$2,295 MCA version for use with an IBM PS/2 or compatible. OCEAN provides toll-free phone support for its products (weekdays from 8:00 to 5:00 P.S.T.), as well as the requisite one-year parts-and-labor warranty. In total, the OCEAN Vista 128 is the superior choice among this group of first-generation 3.5-inch MO drives, offering the best price/performance ratio.

PERIPHERAL LAND INC.

PLI Infinity Optical 3.5-Inch

by Tom Unger

At \$2,099, the PLI Infinity Optical 3.5-Inch offers midrange performance at one of the lowest prices we saw. Peripheral Land's drive, based on the Sony SMO-P301 drive mechanism, is a device that formats like a hard disk and is easy to install and configure.

It features automated installation procedures and a PLI PC QuickSCSI host adapter, for which we didn't need to change the DIP switches or jumper settings when installing it on PC Magazine Labs' test-bed. The half-length card installs in a 16-bit slot. The list price of the system includes the drive, a cable, the host adapter, and one MO disk. Additional formatted disks are available for \$99 each. PLI offers an internal version of the same drive (not tested) for \$100 less than the external version.

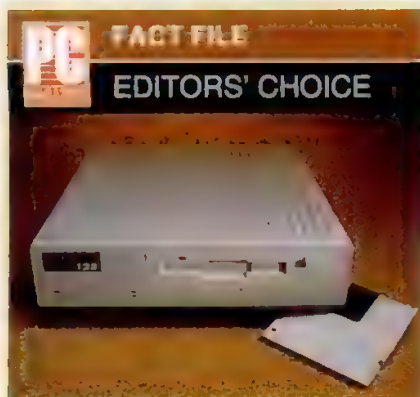
The excellent setup software easily took us through configuration and media preparation procedures, including low-level formatting and partitioning. Like the Procom MEOD128, its software is tailored to individuals not accustomed to installing hardware. The DOS device driver for the unit requires 13K of RAM. Once it was up and running, the PLI operated flawlessly.

The setup software's ease of use, however, is offset by thin documentation. Like the Procom, this drive came with a number of small booklets, each pertaining to a portion of the subsystem. The Procom's documentation was collected neatly in a notebook, while the PLI's manuals, which included those for their Macintosh version, were packed in a seemingly random order. Sorting them out and determining which booklet went with which system component was annoying.

AVERAGE PERFORMANCE

The PLI is not going to blow anyone's doors off in the performance arena. It scored 54.53 and 221.25 kilobytes per second on the DOS File Access tests (small and large records, respectively), took 28 minutes 47 seconds to back up data, and 13 minutes 41 seconds to restore information—strictly midlevel performance.

The company, which provides an entire line of optical mass storage as well as



OCEAN Vista 128

OCEAN Microsystems Inc., 246 E. Hacienda Ave., Campbell, CA 95008-6687; 800-262-3261, 408-374-8300.

List Price: External drive with SCSI host adapter, cable, and one cartridge, \$2,195.

Requires: DOS 3.3 or later.

In Short: The OCEAN Vista 128 is clearly the best price/performance pick of this roundup. Offering a nicely integrated package with well-organized documentation, as well as the best performance of this group, this drive should be at the top of your list.

CIRCLE 478 ON READER SERVICE CARD



PLI Infinity Optical 3.5-Inch
Peripheral Land Inc. 47421 Bayside Pkwy.,
Fremont, CA 94538; 800-288-8754.

List Price: External drive with SCSI host
adapter, cable, and one cartridge, \$2,099.

Requires: DOS 3.31 or later.

In Short: The PLI Infinity Optical 3.5-Inch
offered solid if unspectacular performance. If
you are looking for hard disk compatibility,
ease of installation, and steady performance,
this drive is worth a look, but the real reason to
consider this product is its low price.

CIRCLE 478 ON READER SERVICE CARD

the PLI, offers toll-free technical support
and a BBS weekdays from 8:00 to 5:00
P.S.T., as well as fax support. In addition
to the one-year parts-and-labor warranty,

HARDWARE MAGNETO-OPTICAL DRIVES

customers can extend the warranty for up
to three years at a cost of ten percent of the
purchase price per year.

The PLI Infinity Optical 3.5-Inch won't
provide you with top performance, but it is
adequate. If you are looking to keep costs
down, you will probably find its low price
the most compelling reason to choose this
system.

PINNACLE MICRO

Pinnacle Micro REO-130S

by Tom Unger

Sometimes you should judge a piece of
computer equipment not by how well it
works right out of the box, but by how its
manufacturer responds when it doesn't
work. This was the case with the Sony-
based \$2,274 Pinnacle Micro REO-130S.

The unit ships standard with a full-
length 16-bit Western Digital WD-7000-
FASST2 SCSI host adapter, but the
adapter's on-board ROM attempted to

share the same memory address as our
test-bed Compaq Deskpro 386/25e's video
BIOS and consequently locked the ma-
chine. The ROM BIOS address on the
Western Digital adapter is not user-
selectable, so Pinnacle Micro promptly
sent us a substitute 16-bit adapter from
Phoenix's TenTime Corp.

When the TenTime adapter exhibited
the same conflict, the product support
staff at both companies came up with a
combination of jumper settings our test
platform could swallow. Pinnacle claims
it will ship any one of four boards with the
drive subsystem in order to ensure com-
patibility, with no increase in price.

Among its other assets, the Pinnacle
was one of the smallest in our roundup.
Like the offerings from Procom Technol-
ogy and Relax Technologies, it featured
small plastic feet that enabled it to stand
safely on its side—an important space-
saving feature. The \$2,274 price includes
one disk; additional formatted media will
run you \$79 per disk.

Once we had the adapter properly con-
figured, loading the DOS device drivers
(which take up 3K) was as simple as fol-
lowing the prompts in the automated setup

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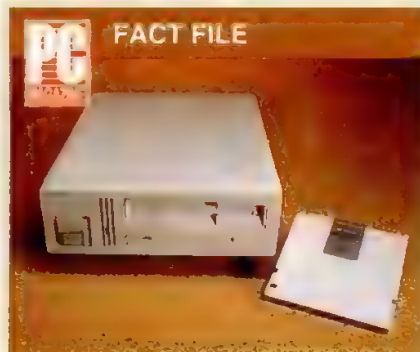
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Pinnacle Micro REO-130S

Pinnacle Micro, 19 Technology, Irvine, CA 92718; 800-553-7070.

List Price: External drive with SCSI host adapter, cable, and one cartridge, \$2,274.

Requires: DOS 3.31 or later.

In Short: Mixed performance results may prejudice you against this drive if you are looking for the fastest file restoration or load times. But by offering a choice of four SCSI host adapters, the company clearly ensures that the drive subsystems it ships will suit its customers' needs.

CIRCLE 480 ON READER SERVICE CARD

HARDWARE MAGNETO-OPTICAL DRIVES

After completing the setup program, the Pinnacle worked without a hiccup.

ERRATIC BENCHMARK RESULTS

The Pinnacle's scores on PC Magazine Labs' performance tests were mixed, however. It was the second-fastest on our XCOPY from Winchester to Magneto-Optical test, handling the task in 26 minutes 14 seconds. But it dropped to fifth place on our XCOPY from Magneto-Optical to Winchester test, where it took 13 minutes 10 seconds to finish the job. It was also more than 2 minutes behind the leaders when we made it load the 25MB TIFF file into a Microsoft Windows 3.0 application (7 minutes 31 seconds). The upshot? If you need speedy backups and don't care if restoring backed up files or loading files takes a bit longer, these discrepancies should not matter. The real handicap may be to users who want to use their Pinnacle drives as near-line graphics storage devices.

Free technical support via a toll-free number is available weekdays from 8:00 to 5:00 P.S.T. The company offers a stan-

dard one-year parts-and-labor warranty that requires owners to ship their defective drives back to Pinnacle for repair. Those wishing to extend the warranty for one year may do so at an additional cost of \$450—a bit steep compared with other units in our roundup. Pinnacle also offers a \$1,995 internal drive based on the MOST drive mechanism.

An excellent space-saving design, solid construction, easy setup, and a dedicated support staff balanced against mixed performance scores make the Pinnacle Micro REO-130S a good choice for those who don't need high-speed restores and are not likely to load large graphics files. If you're looking for a 3.5-inch MO drive strictly for speedy backup and file copying, this drive may well fit your criteria.

PROCOM TECHNOLOGY INC.

Procom MEOD128

by Tom Unger

If ease of installation, clever physical design, and thoroughness of documentation were the only three factors governing drive



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HARDWARE MAGNETO-OPTICAL DRIVES

success, the Procom MEOD128 would be the yardstick by which other MO manufacturers are measured. This package includes excellent, straightforward setup utilities; well-written documentation; a SCSI adapter that works right out of the box; and a case that stands on its edge by means of ingenious plastic supports, allowing it to take up a minimum of precious desk space. This otherwise reputable entry, however, is hampered by lagging performance and a higher price than most of its competitors.

Procom Technology is well known for its wide range of solid hardware offerings. Our \$2,344 test system incorporated a Sony drive mechanism, Procom's own CC16 Enabler SCSI host adapter, the required cable and software, and one disk. The same drive with an 8-bit adapter costs \$2,184. Additional media—either formatted or unformatted—costs \$95 per disk. Be advised that you can't use DOS's FDISK command to low-level-format the media, and you must use Procom's own extensive utility.

The DOS device drivers included with the unit are written using Procom's Pulse, a SCSI development language. While they

easily installed on our test machine (taking up a healthy 8K of RAM), the system left much to be desired in the performance department.

MEDIOCRE TEST RESPONSE

The Procom's performance was always near the bottom of the pack. Even when we loaded ESHADOW.SYS—a driver that shadows Procom's ROM SCSI command set into RAM—the drive's scores never moved into the top echelon (we report scores for the tested default mode, without the ESHADOW driver). Of the eight drives we tested, without ESHADOW.SYS, it placed sixth or seventh on every test except our Large-File Load test, for which it placed eighth by taking 9 minutes 16 seconds to complete the task. This unit is not your best choice for backups; on our XCOPY from Winchester to Magneto-Optical test, the Procom took 29 minutes 24 seconds, placing it about three and a half minutes behind the leader, the OCEAN Vista 128. If your 1GB database needs to be backed up with any regularity, you can expect to spend an



Procom MEOD128

Procom Technology Inc., P.O. Box 8975, Newport Beach, CA 92658-9956; 800-800-8600.

List Price: External drive with SCSI host adapter, cable, and one cartridge, \$2,344.

Requires: DOS 3.31 or later

In Short: Mediocre performance results hurt this subsystem, which is otherwise well-designed, well-built, and easy to install.

CIRCLE 481 ON READER SERVICE CARD

additional half hour at work that day.

Documentation for the product is extensive, neatly organized, and informative. Toll-free technical support is available weekdays from 7:30 to 4:00 P.S.T. The company offers a one-year parts-and-



How To Get It.

Every program in the "PC/Computing Guide to Shareware" is available through ZiffNet, the on-line service all about computing. You can easily download programs from a fully indexed software library; ZiffNet also plugs you into information on what to buy, delivers industry news even before it's in print, and offers forums hosted by the editors of *PC Magazine* and *PC/Computing* to ask for advice or discuss issues. **Call 1-800-666-0330.** And remember, if you want to get into shareware, you need just two things. This guide. And ZiffNet.

Ziff NET

CIRCLE 142 ON READER SERVICE CARD

*CompuServe and ZiffNet members type GO ZNT:PBS for direct access to the software library or type GO ZIFFNET to reach the ZiffNet main menu. © 1992 Ziff Communications.

labor warranty standard, as well as two levels of extended warranty service: The protect option extends the regular warranty for one to three years at \$199 per year. Currently, the company does not offer an internal version of this system.

If speed is not your central concern and you need a solidly built, carefully designed unit made by a company that backs its products to the hilt, the Procom MEOD128 proves a reliable alternative. But if you want fast performance at a lower price, you can do better elsewhere.

RELAX TECHNOLOGIES INC.

Relax Sierra Optical 128

by Tom Unger

The Relax Sierra Optical 128 may present drawbacks for users who want old-fashioned hard disk compatibility from their MO drives. Even so, at \$1,479 with a standard 8-bit, half-length SCSI host adapter, cabling, and one MO disk—\$1,579 if you add the optional external Trantor T338 MiniSCSI parallel-port adapter that we received for testing—this drive may be

too temptingly inexpensive to pass up, despite its inability to be formatted like a hard disk.

Relax Technologies' entry is based on the Ricoh RO-3010E drive mechanism and includes Comeg media (a low \$49 for each additional formatted disk). New to the IBM-compatible market with this drive, Relax took its lead from IBM itself. The setup software included with the unit (written by Trantor, the company that manufactures both adapters) formats the media as a floppy disk instead of the more common fixed-device arrangement. Trantor and Relax claim to be working on a

driver enhancement that will allow the drive to emulate a hard disk. But unlike the mechanism inside the IBM PS/2 3.5-Inch Optical Rewritable Drive, the Ricoh hardware itself does not support interrupt 13h, so even with any enhancements, any actual hard disk calls made by certain programs (such as utility software) will not work.

Regardless of its one-partition mind and the fact that you cannot use it as the boot disk, the Relax was a breeze to install. Each adapter comes with its own software, and a simple installation program prepares the media (obviously, we could not use DOS's FDISK command for low-level formatting). Adding the DOS driver, which takes up a hefty 14K, to your CONFIG.SYS file is automated by the installation program.

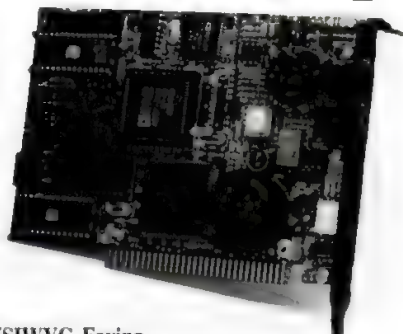
We did not need to set jumpers or DIP switches to access the Trantor T128 internal adapter—even in our finicky Compaq test machine. The MiniSCSI adapter, which will be of interest to users who want to use their MO drive with their laptops, was an even easier subject: We simply plugged it into the parallel port and ran the setup software.

HARDWARE MAGNETO-OPTICAL DRIVES

**The Procom MEOD128
is hampered by
lagging performance
and a high price.**

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CCITT V.42bis / MNP 5	✓	✓
CCITT V.42 / MNP 2, 3 and 4	✓	✓
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* Systems under 525 MB include MaynStream for DOS, OS/2 and Windows

PERFORMANCE UPS AND DOWNS

Because the Relax does not support interrupt 13h, it was unable to run PC Magazine Labs' DOS Disk Access benchmark test.

On the other tests, the drive produced predictably slow scores when we tested it with its external parallel SCSI host adapter, due to the limitations of the parallel port itself. Its scores of 27.52 and 63.32 kilobytes per second on the DOS File Access tests (small and large records, respectively) were the slowest we saw. With the MiniSCSI adapter, its time on the XCOPY from Winchester to Magneto-Optical of 40 minutes 27 seconds bested only the IBM, and its XCOPY from Magneto-Optical to Winchester score of 29 minutes 49 seconds was at the very bottom of the pack.

With the standard internal SCSI host adapter, it generated relatively fast read times. It took third place at 11 minutes 35 seconds when restoring files to a hard disk, and also when loading our TIFF file, which took only 6 minutes 38 seconds. But its score of 31 minutes 39 seconds on the XCOPY From Winchester to Magneto-Optical test bested only the IBM system and its own scores when paired with the parallel-port adapter.

One important caveat: When we tried to load our large TIFF file using the external adapter, we were surprised that the file took nearly an hour to load in Windows' 386 Enhanced mode—nearly eight times

HARDWARE MAGNETO-OPTICAL DRIVES

At \$1,479 with an 8-bit SCSI host adapter, the Relax drive may be too inexpensive to pass up.

the average timing for our other drives. A Relax Technologies representative explained that because Windows constantly polls the parallel port for printer operations in Enhanced mode, the adapter suffers from severe performance degradation. In Standard mode, the file load time was competitive. But having to run Windows in Standard mode will seriously hobble those who hope to use their MO drives with large CAD, graphics, and DTP files. Luckily, you will likely need the parallel-port adapter only when working on the road, so this won't be an issue for everyday office work.

Since the Relax follows the IBM logical-format standard, it was also compatible with the O-ROM media supplied by Sony. Tested with its standard internal host adapter, it bested the IBM on our Sequential Throughput tests.

Relax sells a complete line of optical drives, including MCA and EISA-based units, directly to end users. An internal version of this system costs \$1,299. The company offers a one-year parts-and-labor warranty standard. Relax does not maintain a toll-free number, but technical support is otherwise free. Relax's tech support staff is available weekdays from 8:00 to 5:00 P.S.T. The company maintains a BBS with the latest drivers.

The Relax Sierra Optical 128 is not the choice for anyone who needs 100 percent hard disk compatibility. But with the lowest list price of all the systems we saw and decent (if not top-tier) performance when used with its internal adapter, it may present a viable alternative for others. ■

M. David Stone is a contributing editor of PC Magazine. Nick Stam is the technical director of PC Magazine Labs. John R. Quain and Tom Unger are frequent contributors to PC Magazine.



Relax Sierra Optical 128

Relax Technologies Inc., 3101 Whipple Rd., Union City, CA 94587; 510-471-6112.

List Price: External drive with SCSI adapter, cable, and one cartridge, \$1,479; parallel port adapter, \$100.

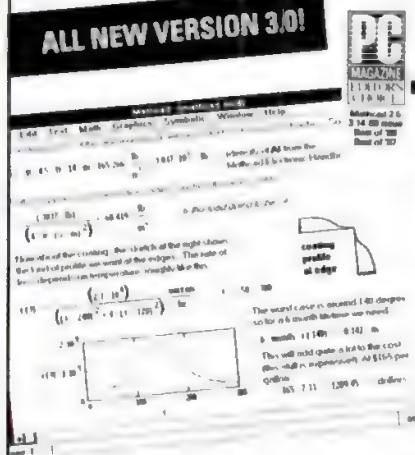
Requires: DOS 3.31 or later.

In Short: Like the IBM unit, the Relax Sierra Optical 128 formats like a floppy disk rather than a hard disk drive. Its chief virtue is the lowest price of this roundup. Laptop users may opt for the convenience of its parallel port SCSI host adapter, even though it will not provide the fastest performance.

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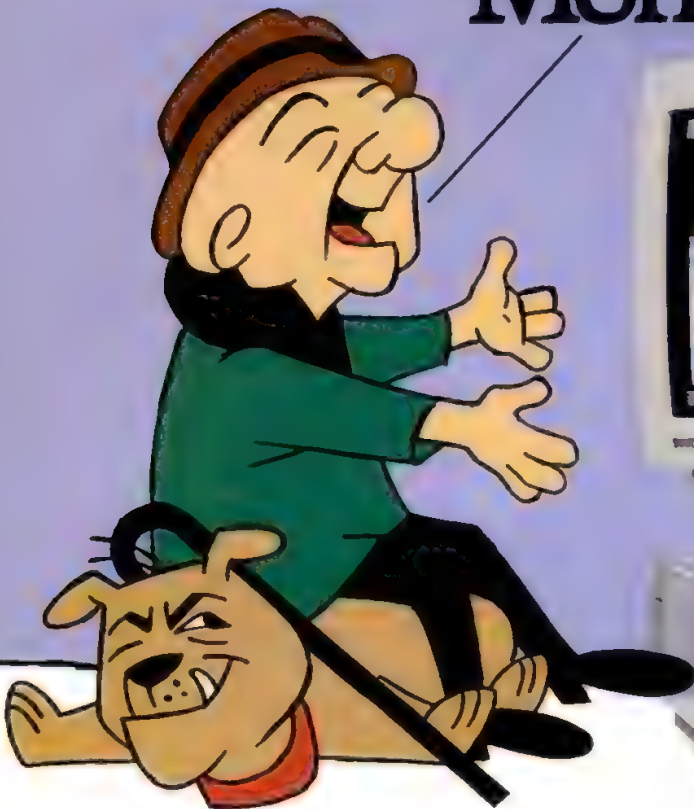
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VICTORIA KANN

BY ALFRED POOR

Database publishing software brings us a step closer to streamlining the tedious process of publishing catalogs, directories, and other data-driven documents.

Twixt dBASE And DTP

Five Database Publishing Programs

Face it: Database information tends to be as dull as dishwater. There are no 3-D graphics, no gradient fills, no animation, no sound: just lists of names, addresses, inventory numbers, and prices. Sure, this information is the fuel that drives American business, but for the most part it is destined to wind up on endless reams of pin-fed greenbar print-out paper. What is there to get excited about?

With the availability of sophisticated desktop publishing and word processing programs and inexpensive laser printers, we are beginning to expect our database output to be every bit as attractive as our spreadsheets and memos. But while most database programs are suited to reporting data in any juxtaposition imaginable, they know little about the page layout and

formatting at which desktop publishing (DTP) programs excel. Database programs also put most sophisticated report generation beyond the reach of nonprogrammers.

Conversely, it is burdensome to import a text file from a database into *Aldus PageMaker* or *Ventura Publisher*; if you want to bold-face all of the people's last names in a directory, for example, you have to go through the entire document and apply the bold attribute by hand. And all data manipulation, selection, and extraction must be performed within the database program. This is hardly the relief from labor that we expect from a computer.

FILLING THE NICHE

There is an answer: database publishing programs. These products are designed to fill the gap between database programs and desktop publishing programs by allowing data-driven page layout and formatting.

In essence, database publishers take data files and apply formatting to individual fields based on general instructions that you supply. Most of these programs also perform other handy tasks along the way, such as supplying headers and footers, sorting the records into new sequences, selecting only specific records that you want to use, and even performing grouping and summary calculations such as counts, averages, and totals. You can link related data tables using common fields. Some programs even allow you to create dictionaries that are used to perform substitutions: For example, if you sort addresses based on the postal state abbreviations, the states come out in the wrong order, but a substitution dictionary can be used to create a sort based on the states' full names. Database publishing programs can also perform different kinds of formatting and string manipulation functions, such as adding commas or dollar signs to numbers, or recognizing when the first letter of a field has changed and triggering the start of the next alphabetical section in a listing.

Some of these functions are provided

by database report writers (see the sidebar "In the Beginning . . . Report Writers"), but for the full typographic control demanded for publication-quality output, you need a database publishing program.

The products in this category range widely in terms of features and abilities, but in general, they all require more than an afternoon to learn and can take many days of practice to master. If you are working with a database program such as *dBASE* or *Paradox* and are a proficient program-

mer with its language, then you can probably reproduce much of what these programs have to offer by writing code that will insert the appropriate formatting codes for you.

Database publishers take data files and apply formatting to fields based on general instructions that you supply.

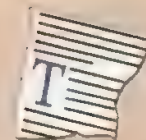
If you are more comfortable on the desktop publishing side of the equation, however, then these programs are for you. Database publishing programs allow you to take data files and create formatted files ready for processing with a desktop publishing program, or in some cases a word processing program, even if you do not have the database program itself.

This capability is handy if you are responsible for producing on a one-time basis for different projects. It is also a great time-saver when you have to produce the same type of document—such as a directory or price list—based on information that changes frequently. In this case, you can create the set of rules once in your database publishing program and then crank out a new DTP file every time the data changes.

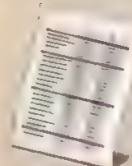
Database publishing programs cover a wide range of features. Some of the earliest ones in the PC market predate the boom in desktop publishing, and as a result they are designed to work as stand-alone units without a desktop publishing program as their destinations. The latest

RATING THE PRODUCTS: SUITABILITY TO TASK

Because the data component of database publishing changes frequently, the ability to update publications automatically enhances the performance of all tasks.



A package that eases the process of creating **Directories** generally features robust, data-driven layout capabilities. These include character formats and section, paragraph, and line breaks, all of them field-determined. As with table creation, the package should be able to handle complex queries, multiple-key sorts, and simple substitutions.



While creating **Tables** is a relatively simple layout task for a database-publishing package, it can require some advanced data handling, including multiple-key sorting, calculated fields, complex queries, and simple substitutions. This rating also reflects each package's basic character-, header-, and footer-formatting capabilities.



In many ways **Catalogs** are directories with more complex layouts. In addition to the capabilities necessary to create directories, a product suited for catalog creation should be able to handle the placement of database-specified graphics, advanced character formatting, and complex field calculations.

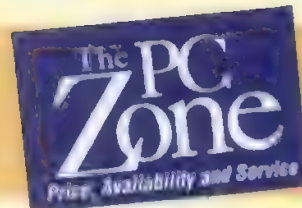
SUITABILITY TO TASK Product Name

Tables	■ ■ ■ ■	4—Excellent
Directories	■ ■ ■	3—Good
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Catalogs	■	1—Poor

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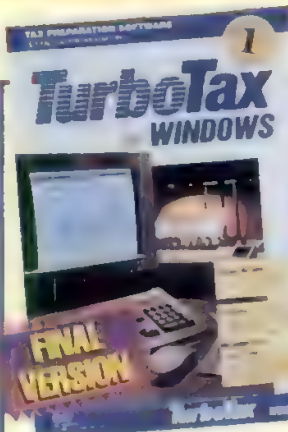


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07434 Instant Database Win	48 W
Borland International	
08010 DBase IV 1.1	479
08019 Paradox 3.5	519
08016 Paradox 3.5 Comp. Upgr	148
08019 Paradox 3.5 Single Ntwk	199
08014 Paradox SE	65
07644 Quattro Pro 4.0	328
07646 Quattro Pro 4.0 Comp. Upgr	88
09781 Quattro Pro SE V.1.0	46
For Software	
09611 Fox Pro 2.0 Single	458
Franklin	
07146 Lang Master DOS 201	44
Lotus	
09557 Lotus Ami Pro 2.0	299 W
09723 Lotus Ami Pro 2.0 Comp Upgr	99 W
09476 Lotus 123 Rel 2.3	335
09476 Lotus 123 Rel 3.1a	428
09669 Lotus 123 Win	399 W
09674 Lotus 123 Win Comp Upgr	89 W

09670 Lotus 123 Win Tech Guarnt	49 W
09724 Lotus Double Up Bundle	158 W
Microsoft Corporation	
09381 License Pak For Excel 3.0	269 W
08934 MS Excel 3.0 For Win	298 W
07404 MS Word Win 2.0 Comp Upgr	128 W
09974 MS Word for Win 2.0	309 W
Software Publishing	
08118 Office Writer 6.2	234
08146 Express Writer 2.2	159
08146 Express Writer Plus	168 W
Spinnaker	
07007 PFS First Choice 3.1	85
Symantec	
08016 Symantec 1.0 For Win	129 W
08016 Symantec 1.0	69
WordPerfect Corporation	
09021 WordPerfect 5.1	128
08172 WordPerfect 5.1	239
09217 WordPerfect 5.1 - 20 Pack	3300
09216 WordPerfect 5.1 - 5 Pack	1100
09349 WordPerfect 5.1 For Win	279 W
07017 WordPerfect 5.1 Add-on 20 pack	2948
07017 WordPerfect 5.1 Add-on 5 pack	208
07611 WordPerf 5.1 Add Luc w/o Doc	174
09681 WordPerf 5.1 Trade-up	139
09388 WordPerf 5.1 Upgrade	77
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09900 ATI VGA Wonder/Excelw/Mse	198
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09432 Persuasion 2.0/Win	329	W
07214 Freehand 3.0 For Win	388	W
Asymetrix Corp.		
07435 Make Your Point Win	48	W
Banner Blue Software		
09786 Org Plus Adv. 6.0	67	
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07171 Fractures 2.0	49	
07168 Fraczooms 1.0	33	
Computer Support Corp		
09050 Arts & Letters Graph Ed 3.1	365	
08292 Dream House Professional	46	
Coral Systems		
08642 Coral Draw 2.0	368	W
Digital Research		
08582 Gem Presentation Team 2.0	315	
08296 Gem Artline V2.0	409	
hDC Computer		
09889 Icon Designer 2.0	33	W
Lotus Corp		
07163 Freelance For Win	348	W
07430 Freelance For Win Upgrade	99	W
09528 Freelance Graphics 4.0	329	
09892 Lotus Freelance 4 Comp Upgr	89	
Micrografx		
08308 Charisma For Win	339	W
07225 Windows Draw	109	W
07622 Designer 3.1 w/ATM 2.0&ATA	459	W
09350 New Wave Charisma	323	W
07221 Picture Publisher 2.1 DOS	418	
07223 Picture Publisher Plus Win	489	W
Microsoft Corporation		
08198 Powerpoint for Win	315	W
07209 Powerpoint for Win Comp Upgr119	119	W
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08289 Instant Recall 1.2	62	
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07008 Packrat 4.0 For Win	254	W
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08122 Calendar Creator Plus V4.0	48	
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08565 Quick Schedule Plus	63	
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08872 Yourway For Win	148	W
Softnet Communications Inc.		
07425 Maximizer Memory Manager	34	
Software Publishing		
08517 Harvard Project Manager 3.01	469	
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IN THE BEGINNING...REPORT WRITERS

by Rick Ayre

Almost as long as there have been computers, people have been generating printed reports from the information stored in data files. Traditionally, the publication of data has been the sole province of the database application that generated it. While the new generation of database publishing software provides tools to build large formatted documents, report writers are still the best way to turn out small, focused reports: weekly profit and loss statements and monthly inventory summaries, for instance. Report writers tend to be easy to use, and they are targeted at end users who want to perform ad hoc queries without knowing anything about a database manager.

Clearly, the product categories overlap. Report writers and database publishing packages both perform complicated mail merges. Today's report writers allow users to create summary report templates that combine files in *dBASE* format with *Lotus 1-2-3*, *Microsoft Excel*, *Paradox*, or other file formats; some of the best database publishing programs also allow this. Some report writers also allow users and developers to create reports from data on a single user's hard disk; others can create reports from data shared on a network or stored on file servers.

PRIMARILY FOR DEVELOPERS

When it comes down to it, report writers do one thing well: They allow you to create report templates. Report templates are report definitions or page layouts that you design. These templates tell the report writer how you want your report to look and what data you want to go where. You save templates as files, then distribute them in conjunction with a custom-built database application or share them in a corporate network environment. Or you can use them each time you want to generate a certain type of report.

Since report writers arose as a response to the limitations of *dBASE*, it is not surprising that they often allow you to generate Xbase code. This ability is particularly useful for small in-house developers and professional database programmers, and it has ensured report writers an important market niche. Some of these products even include runtime distribution modules, so developers can distribute report templates as part of custom-built applications without fear that their applications will be modified.

R&R REPORT WRITER

R&R Report Writer is a good example—perhaps even a best of breed—of a report writer. This program, from Concentric

Data Systems (Westborough, Massachusetts; 508-366-1122), provides everything you would expect from a report writer, as well as a lot of what you would expect from a desktop publishing package.

You use *R&R* interactively, via *Lotus 1-2-3*-style menus, to create a report template. The basic version of the program costs \$249 and comes in three different flavors based on what type of data it can access: *DBF*, *Lotus 1-2-3*, or *Paradox* files. A \$299 version offers three varieties of access to network databases: *Oracle*, *NetWare SQL*, and *XDB-SQLA* versions.

The completed template is compiled into a binary file, which can be run every time you want to produce the report it creates. Reports can be called from an Xbase program or simply run by an end user. *R&R* comes with a runtime module that can be distributed with the compiled report.

Running reports compiled with *R&R* requires quite a bit of memory: 384K. Since memory is often dear in large customized database applications, Concentric recently introduced a \$199 report code generator that works in conjunction with and requires *R&R* for *dBASE* and com-

patibles, version 4. Instead of compiling a report template, you generate commented source code that creates the report. The code may then be edited and included in an application. Code can be generated for many Xbase languages, including all versions of *Clipper*, *dBASE*, and *FoxPro*. Although this process conserves memory, users report that it does so at the expense of runtime execution speed. Compiled reports are generally faster, but runtime versions require only 25K.

Although marketed as a report writer, *R&R* will almost match desktop publishing packages feature for feature. It can generate reports with proportional fonts for LaserJet and PostScript printers, and it has a WYSIWYG print preview mode. But you cannot incorporate graphics into your reports, and *R&R* has nothing to approximate page paste-up.

If you are developing database applications and you want to distribute these applications, you will want to look at report writers. If you want an interactive character-mode application that is simple and easy to learn, you should consider report writers. And if you want to generate source code to be compiled into standalone database applications so that end users can create reports, you must consider a report writer.

Report writers and database publishing programs both strike at the heart of the computer revolution. After all, they retrieve information from wherever it happens to be stored, and move it to where it is needed—in the form that is most understandable. ■



In *R&R Report Writer*, for example, you use dummy characters as placeholders when creating the page layout.

version of such a program is *dbPublisher ProPlus*, from Digital Composition Systems. This powerhouse program starts with your data file and ends up sending formatted output directly to your printer, including pictures in place and generated bar codes if you need them.

Standalone products can be more complex to use, however, and the target audience for this category has probably already developed some mastery of a DTP or major word processing program. As a result, we have limited this review to products that are designed to produce formatted files for use with another program: *Aldus PageMaker*, *Ventura Publisher*, or a major word processor such as *WordPerfect for Windows* or *Microsoft Word for Windows*.

APPLES AND ORANGES

Five products made the cut: HP Type & Graphics' *DataPub*, ElseWare Corp.'s *DataShaper*, Digital Composition

Systems' *dbPublisher for Ventura*, Page-Ahead Software Corp.'s *PageAhead*, and Ventura Software's *Ventura DataBase Publisher*. There is a surprising range of features—and prices—within this field. *DataPub* is a DOS character-based application, *dbPublisher for Ventura* uses a proprietary GUI, and the rest run under Microsoft Windows; Ventura Software also offers a GEM-based version of *Ventura DataBase Publisher*. Some of these products work only with *dBASE* files, some only with ASCII text files, and some with all sorts of formats, including *Lotus 1-2-3* worksheets. Some work only with one file at a time, some can relate multiple files based on common fields, and some can even relate database, worksheet, and text files based on shared fields. Some packages work only with *Ventura Publisher*, some only with *Aldus PageMaker*, and some with both, as well as

most of the major Windows and DOS word processing programs.

In short, there is something for everyone. With this broad a feature set, it was a bit challenging to come up with a set of common tests for use in evaluating the five products. With the help of Teresa Kreuger, a New Jersey-based graphics consultant at Electronic Directions, we came up with three different publication designs. The first was a simple product list with one record per line, sorted by company, and only listing the company's name once (suppressing it for subsequent lines if the company had more than one product). We made the task more difficult by looking up the product category from a separate data file, and then sorting on the category if the program could.

The second task was more complicated: a phone and product directory. The company name, address, and phone number were printed, one item per line, followed by the name and numbers for the marketing contact. If any of these items were missing for a company, then the item was skipped, without leaving a blank line. The products and their categories were listed, but without repeating the company information if there was more than one product.

The third task required the package to format a catalog page, pulling images from disk and placing them on the page, plus using some complex text formatting such as crossing out the list price and calculating the sale price if there was a discount present for that record.

Suffice it to say that no product managed to complete all the reports perfectly. All five products managed to perform part of each test, but differences in features and design philosophy prevented any package from completing all the tests.

MAKING A CHOICE

Of course, since these programs take such markedly different approaches to achieve the same goal, it's too simplistic to merely choose the one that performs a given task best. So how do you know which one is right for you?

The first place to start is with your output requirements. If you use only *Aldus PageMaker*, *Ventura Publisher*, or *Microsoft Word for Windows*, then your choices will be limited right from the start. The next consideration is your data: What file format is it in? Do you need to relate multiple files, or are you simply working with a single database file? If you



EDITORS' CHOICE

■ PageAhead

Database publishing could be more accurately referred to as *data-driven* publishing; if a database publishing package lacks robust data-handling capabilities, it's probably not much of an improvement over your desktop publishing or word processing program.

As is frequently true in immature product categories, the best of the packages that we tested also happens to be the most expensive. Priced at \$795, PageAhead Software Corp.'s *PageAhead* excels at both the data handling and formatting aspects of database publishing. *PageAhead* supports multiple simultaneous active data files, features robust query facilities, and works with popular word processors and *Aldus PageMaker*. And, most important, *PageAhead* provides all this power without sacrificing ease of use.

For those who need to balance power with price, need a sophisticated package that does not require Microsoft Windows, and want to use *Ventura Publisher*, Digital Composition Systems' *dbPublisher for Ventura* certainly earns an honorable mention. For the less-burdensome price of \$199,

dbPublisher for Ventura delivers a plethora of useful data-handling capabilities; the only drawback is that they are lodged in the GEM interface, which requires a bit of a struggle to master.

Another honorable mention goes to Ventura Software's *Ventura DataBase Publisher* (Windows version). If you have relatively modest data-handling needs and want to use a desktop publishing package for your page layout, this easy-to-use \$295 package will handle most requests with aplomb.

HB Type & Graphics' *DataPub* and ElseWare Corp.'s *DataShaper* are more limited in use. *DataPub* simply tags a data file for import into *Ventura Publisher*; but at \$99, *DataPub* may be a useful utility for some. The \$249.95 *DataShaper* is actually a set of data-savvy import and export filters that work within *PageMaker*. *DataShaper* is fairly weak at data manipulation, but *PageMaker* users who would rather stick within that application than jump out to a database program will certainly find *DataShaper* as useful as any of *PageMaker*'s other import filters.

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Notebook	CPU	RAM (MBs)	HD (MBs)	Battery Life (Hrs)	Price
386SXL/25	386SXL-25 MHz Optional 80387SX	2 standard 4 & 6 options	60	3+	\$1,699 \$63/mo*
386SL/25	Intel 80386SL-25 MHz 64 K CPU cache Advanced SL power mgmt Optional 80387SX co-processor	2 standard 4 & 6 options	80	3+	\$2,199 \$81/mo*
486SX/25	Intel 80486SX-25 MHz Built-in 8K CPU cache	4 standard 8 & 20 options	80	2.5+	\$2,999 \$111/mo*
486DX/33	Intel 80486DX-33 MHz Built-in 8K CPU cache	as above	120	2.5+	\$3,499 \$138/mo*



24

HOUR

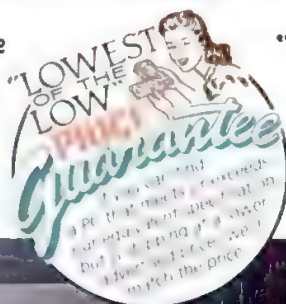
FAX: 1-214-702-0300

COMPUDYNE

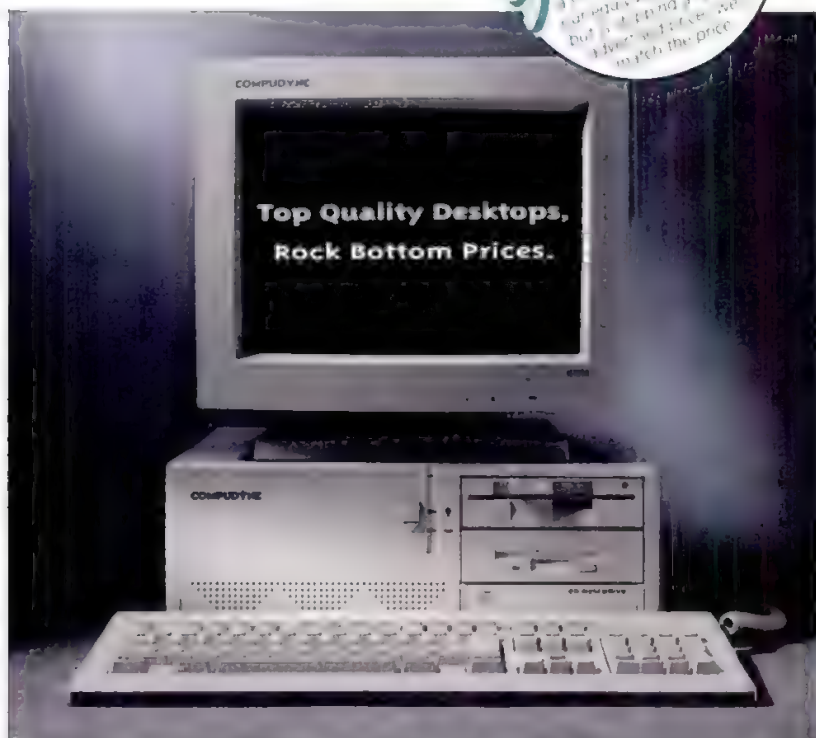
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386SX/25	Intel 80386SX-25 MHz	1 standard 32 max	40	1.2 or 1.44	16 bit SVGA card 14" 640x480 VGA color monitor	\$899 \$33/mo*
386SX/25	Intel 80386SX-25 MHz	1 standard 32 max	80	as above	as above	\$999 \$37/mo*
386DX/25	Intel 80386DX-25 MHz	2 standard 32 max	80	1.2 & 1.44	16 bit SVGA card 14" 1024x768 SVGA color monitor	\$1,299 \$48/mo*
386DX/33 CACHE	Intel 80386DX 33 MHz 32K CPU cache	4 standard 32 max	120	as above	16 bit SVGA card w/ 1MB video RAM & 32,000 color support 14" 1024x768 SVGA non-interlaced color monitor	\$1,699 \$63/mo*
486DX/33 CACHE	Intel 80486DX-33 MHz 128K CPU cache	4 standard 64 max	120	as above	as above	\$1,999 \$74/mo*
486DX2/50 CACHE	Intel 80486DX2-50 MHz 128K CPU cache New Double Clock CPU	4 standard 64 max	210	as above	as above	\$2,499 \$89/mo*

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CIRCLE 132 ON READER SERVICE CARD

are going to be updating your published data frequently, the ability to perform this task automatically is an important issue.

Finally, consider the sophistication of your processing requirements and the amount of time and effort you are willing to invest toward mastering the features necessary for producing those results. Do you need complex selection queries, sorts, string processing, and other functions? If so, make sure the program you choose can get the job done. If you do not need these extra strength features, do not burden yourself with a program that is more complex than you need.

Note that one criterion missing from this list is price. While it is true that the top and bottom prices are separated by hundreds of dollars, do not be deceived by price. A program that is difficult to use can easily waste hundreds of dollars of your time. And a program that will not do the job at all is a waste at any price.

Also keep in mind that like many other segments of the software market, prices in the database publishing market are on the way down. The price for *dbPublisher for Ventura* has dropped 20 percent within the past year, and *PageAhead's* price reflects a recent drop as well. And even the standalone products are dropping in price; Digital Composition Systems has released the first in its Instant Publishing Series, its \$99 *Instant Directory Publisher*, which provides easy-to-use, task-specific database publishing.

There are other developments that will affect your decision. Many of the latest generation of word processors have become increasingly sophisticated in their handling of database files and may give you the results you want with minimal effort. We also have yet to see the arrival of a true Windows database program that includes powerful reporting features. To this point we have file managers and forms programs, but there are products waiting in the wings that could change the whole picture, such as *Paradox* and *dBASE for Windows* from Borland International, or Microsoft Corp.'s forthcoming database product, code-named *Cirrus*.

One fact is for certain: While there will still be a market for pin-feed greenbar print-out paper for some time to come, you can expect to see increasing amounts of your database information show up in a more attractive format. And one of these five database publishing programs may be just what you need to dress up your information yourself.

All reviews by Alfred Poor

HB TYPE & GRAPHICS

DataPub

DataPub's modest outlook matches its modest \$95 price. The program is easy to describe: It turns a .DBF file into a *Ventura Publisher* text file or a *Ventura*-tagged *WordPerfect* file. That's all. You cannot select records based on search criteria, look up data, or link to other database files. But you can use *Ventura* tags, though the program cannot create a *Ventura* style sheet.

Despite these limitations, *DataPub*, from HB Type & Graphics, has some useful features. While it will not sort your database file, it can use an index and can even create a new index on multiple fields if you choose. You can also choose to apply an UPPER function to a field's contents to make the database sorting case insensitive, which can be a plus when you are creating a directory.

You must choose between *dBASE* and *Clipper* format indexes when you first install the program; *Clipper* is recommended for faster performance. You don't really need index files, however, because the program can create them for you—it can even concatenate fields to create a multiple field index. You can also create files in .DBF format from comma-delimited and fixed-length ASCII files.

After you have picked a database file (and possibly an index), you can create a template, which is a list of fields from the database, plus extras. You can specify one or more items, such as *Ventura Publisher* codes for text characteristics or spacing, to appear before the field's contents in the output file. Or you can enter literal text that you want to precede a field's con-

tents, such as "Phone:" before a phone number. You can also specify a *Ventura* tag prefix and whether a carriage return should follow the field's contents in the output file.

In addition to the template, *DataPub* gives you a header field option that allows you to generate initial letters or section headers when the contents of a field change. This grouping works on a single field and is only one level deep, but this can be enough for simple applications.

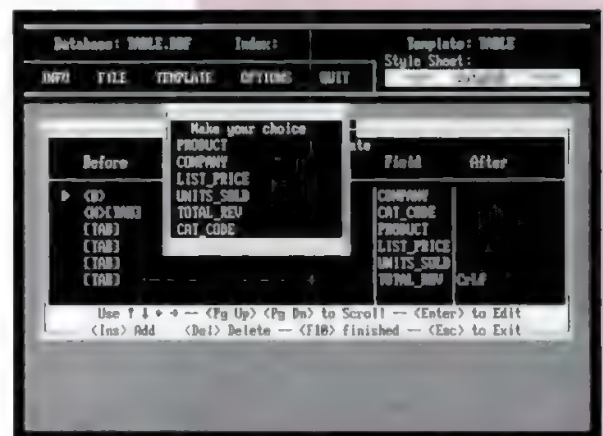
CREATING THE OUTPUT

DataPub offers few choices for output: ASCII or *WordPerfect* file format. The *WordPerfect* option lets you edit the output file with that program, but you can achieve nearly the same results with *WordPerfect's* Text In/Text Out feature.

There are two modes of working with the package: Learning and Fast. The Learning mode allows the package to reformat variable records, and the program can be trained to handle each variation. The Fast mode simply creates output for all records, regardless of their contents.

DataPub's modest outlook is matched by its documentation. The slim, comb-bound manual is well written, follows a

SUITABILITY TO TASK				
DataPub				
Tables	■	■	□	□
Directories	■	■	□	□
Catalogs	■	□	□	□



A *DataPub* template consists of a list of fields from a *dBASE* table and other items that are to appear either before or after each field's contents. *DataPub* provides a list of field names to make selection easy and fast.

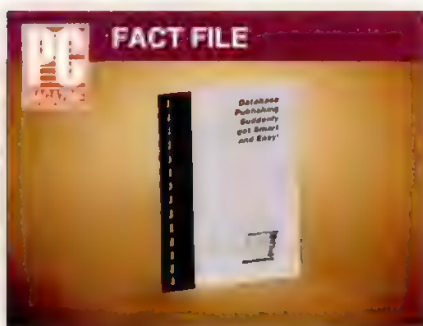
ELSEWARE CORP.

DataShaper

fairly clear structure, and has a table of contents, but it lacks a thorough index. And while *DataPub* includes some good screen shots that can help you understand various features, it lacks a tutorial to help you learn how to use them.

The program also has some quirks and problems. It is a character-based DOS application, with a fairly typical *Lotus 1-2-3*-style command menu. But where most programs with this type of interface give you the logical alternative of pressing the Down Arrow key to drop down menu subcommands, *DataPub* only uses Enter. In addition, the program bombs if you create a line in the template that does not reference a field. There is no error message to warn you that this is not allowed, but the resulting output file is empty. If you try to reopen the template, you will get a message that the template does not match the database. The company plans to fix this flaw in future versions.

For now, however, the product is still serviceable—provided that your expectations fit its capabilities. *DataPub* really does little that you could not do with a dozen lines or so of *dBASE* code; but if you don't know how to program in *dBASE*, this program is a reasonable, menu-driven alternative. *DataPub* can produce simple text files that will save you a lot of formatting time in *Ventura Publisher*, and if your needs are not too complex, it will do the job well. At this price, you can afford to try this one first, and then move up to one of the more feature-rich packages if your needs expand.



DataPub

HB Type & Graphics, 1615 Alabama St.,
Huntington Beach, CA 92648; 714-536-3939.
List Price: \$95.

Requires: IBM-XT or compatible, 570K RAM,
CGA display, DOS 3.0 or later.

In Short: *DataPub* does only one thing—it turns .DBF files into *Ventura Publisher* text files—but it does that fairly well. And with its modest \$95 price tag, you can afford to buy *DataPub* first, and then upgrade to a more feature-laden package if your needs become more complex.

CIRCLE 481 ON READER SERVICE CARD

While it is priced in the middle of the pack at \$249.95, ElseWare Corp.'s *DataShaper* is clearly at the bottom in terms of features and capabilities. The program's main attractions are its ease of use and its ability to run seamlessly within *Aldus PageMaker*.

The rest of the programs in this group are independent applications; they take in database information and produce a text file formatted for the target desktop publishing or word processing program. *DataShaper* works quite differently from the rest: It is actually a set of import and export filters that installs directly into *PageMaker*. You use this program to create a *DataShaper* format file, which is then used to import your data.

The format file is simply a *PageMaker* document with a section that determines the sequence and formatting of the fields you want to import. You define the sequence with placeholders; %a, %b, and %c are the standard placeholders for the first three fields. For example, if the first three fields in your data file are first name, last name, and department, and you want to list the information as department, last name, and then first name, your format file would have this line: %c %b %a.

There are additional placeholders besides the standard ones, including placeholders that do not strip a trailing carriage return from a field (the standard ones do) and others that show a field's contents only if they are different from the corresponding field's in the preceding record. There is also a placeholder that allows you to substitute a section of text or one field's contents for another field's if the first field is not empty, and a similar one that substitutes a section of text if the field is empty.

One of *DataShaper*'s surprising strengths is its use of placeholders that interpret a field's contents as a graphic's filename, thus allowing you to import the image directly into your *PageMaker*

document. The program reads a variety of image formats—.WMF, .PCX, and TIFF—but you can only use one kind of graphic in a document; there is no clear explanation of this restriction.

FORMATTING THE FILE

After you have finished entering placeholders in a document, you can apply character formatting to them, such as type style and size, as well as typographical effects. You can also include tabs and carriage returns to control the placement of field contents on the page. When you are finished formatting, you move the entire text block (with the placeholders) onto the pasteboard surrounding the *PageMaker* page to be saved. The file is then

ready to be exported as a *DataShaper* format file.

When you place the format file, *PageMaker* asks for a data file to use with it. Select the file you want, and

use *PageMaker*'s Autoflow when placing the text to add as many new pages as required to accommodate your data.

Although straightforward to use, *DataShaper* has some significant limitations, especially in the area of data files. The documentation claims compatibility with a long list of programs, including *dBASE*, *Lotus 1-2-3*, *Microsoft Excel*, *Paradox*, and *R:BASE*, but the fact is that the program cannot directly read files

SUITABILITY TO TASK
DataShaper

Tables	☒	☒	☐	☐
Directories	☒	☒	☐	☐
Catalogs	☒	☒	☐	☐



DataShaper

ElseWare Corp., 3201 Fremont Ave. North,
Seattle, WA 98103-8866; 206-547-9623.
List Price: \$249.95.

Requires: 286-based PC or better, 640K
RAM, Microsoft Windows 3.0, *Aldus PageMaker* 4.0, mouse, 1MB RAM
recommended.

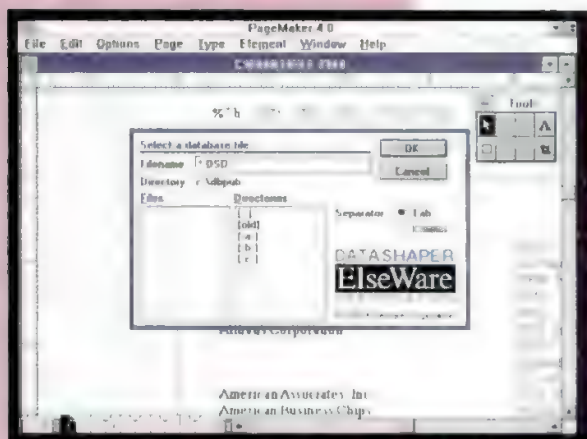
In Short: *DataShaper* works almost seamlessly within *Aldus PageMaker* to import data in ASCII format, but its limited data-file import options make it less useful than its competitors.

CIRCLE 482 ON READER SERVICE CARD

from these programs. It can only import data in either comma-delimited or tab-delimited ASCII text formats. All the database programs listed are certainly capable of exporting their data in this format, but it means that you must have the source program in order to convert the data from its native format. In addition, *DataShaper* cannot read fixed-length format text files, a noticeable deficiency.

The problems do not stop there, however. *DataShaper* cannot sort or select records from a data file, nor perform any operations on field data, other than constant text insertion. It lacks string manipulation, formatting functions (such as the ability to add commas to numeric fields) and mathematical operations. In addition, the program can only work with one file at a time, so forget about using secondary data files or lookup tables. Due to these limitations, *DataShaper* could not complete any of the reports in our test suite.

DataShaper is severely limited in its capabilities. If you work with *Aldus PageMaker* and need to import lists of information from applications that can produce comma- or tab-delimited text files without doing much processing, then *DataShaper's* ease of use and simplicity will make it a good choice for you. But if your needs are more sophisticated, you will do better choosing a different package.



DataShaper works within *Aldus PageMaker* as an import filter; it processes database information based on a format file containing placeholders for the various fields. You apply formatting to placeholders so it will be applied to the imported data.

DIGITAL COMPOSITION SYSTEMS INC.

dbPublisher for Ventura

Digital Composition Systems is one of the pioneers in database publishing on the PC. Its stand-alone product, *dbPublisher Pro-Plus* (\$495), is one of the most capable products of its class. And if you want to use *Ventura Publisher* to format your output, you can get almost as much power from *dbPublisher for Ventura*. At \$199, this power comes at a bargain price.

dbPublisher for Ventura's most striking feature is its proprietary graphical user interface (GUI); the GUI operates similarly to Microsoft Windows, but is different enough to be disconcerting. *dbPublisher for Ventura* is very mouse-centric, and in many cases the only way to issue a command or edit a field is via the mouse. While Windows activates many commands with a double-click, most *dbPublisher* actions activate with only a single click. Statement syntax is complicated; some elements

require that you bracket them in single quotes. Commands are found in unexpected places; you do not quit from the File menu, for instance, but from the unlabeled control menu instead. And rather than graying out unavailable commands, *dbPublisher for Ventura* simply fails to display them; as a result, some menus are empty and will not open. Mastery of the interface is essen-

tial, but this makes up only part of the steep learning curve for this program. *dbPublisher for Ventura* is more like a structured programming language than anything else.

When you start a new report format, the program creates an outline with various components that require you to spec-

ify the name of the *Ventura Publisher* chapter style to use, the data files to open, the statistics and totals to track, and the detail for the output.

The output detail includes the name of the destination file, selection criteria, and sort orders. You can select and sort from multiple files, as well as sort by multiple fields and calculated fields. You can use *dBASE* files, or you can access data from most major database programs, most spreadsheets, and fixed- and comma-delimited text files. And you can create links between the data in these files based on common fields, so you can use a

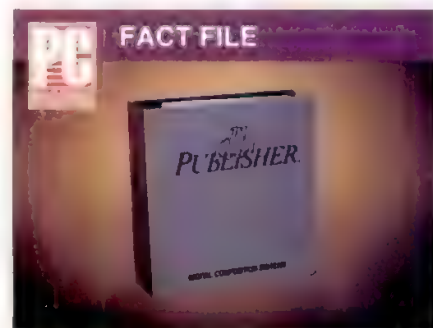
Lotus 1-2-3 worksheet as a lookup table for data in a *Paradox* database. Joins between files take longer to process than with some other programs, however, because

dbPublisher for Ventura does not use *dBASE* index files.

You use an output line in the initial outline to actually write data to the output file. In that output line you specify which fields to print and their order. You can also specify calculations based on the contents of fields or specific text and apply *Ventura* tags to a field's contents (reading the tags from the target style sheet if they have already been defined and creating a new style sheet on the fly if one has not yet been created). You can

SUITABILITY TO TASK dbPublisher for Ventura

Tables	■	■	■	■
Directories	■	■	■	■
Catalogs	■	■	■	■



dbPublisher for Ventura
Digital Composition Systems Inc., 1715 W. Northern Ave., #201, Phoenix, AZ 85021; 800-527-2506, 602-870-7667.
List Price: \$199.
Requires: 286-based PC or better, 512K RAM, CGA display, mouse.
In Short: *dbPublisher for Ventura's* arcane structure and proprietary interface are not easy to learn, but mastering the package pays off with extremely powerful and flexible formatting features for *Ventura Publisher* files. If you need to perform complex data manipulations, this is the program to choose.

CIRCLE 463 ON READER SERVICE CARD

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Put any of our other Quiet Technology printers to work and you can accomplish whatever your needs.

From our 2123, a budget-minded 24-pin with Adobe Type Manager* and optional



color...to our 2624 wide-carriage business printer with ATM*,...to our 9-pin 2180 with 6 near letter quality fonts and optional color.

All with the kind of features that made Panasonic printers the leaders of the industry. Such as multiple paper paths, EZ™ Set control panels, and a two-year limited warranty on parts and labor†.

The Panasonic 2000 Series Quiet Technology Printers.

Call us for more information: 1-800-742-8086. Or visit your Panasonic dealer.

† See your dealer for warranty details.

* ATM and Adobe Type Manager are registered trademarks of Adobe. Available on selected printers only.



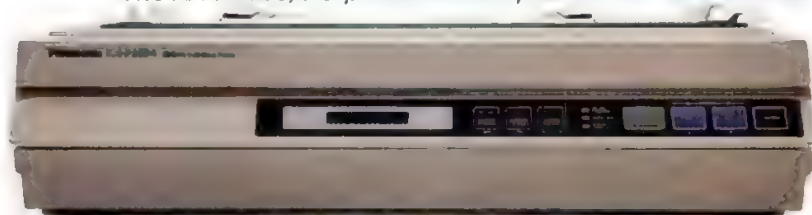
**ONCE YOU'VE TRIED OUR
QUIET TECHNOLOGY PRINTERS,
YOU'LL NEVER SETTLE FOR
ANYTHING LESS.**



The KX-P2123, a 24-pin with ATM and color option.*

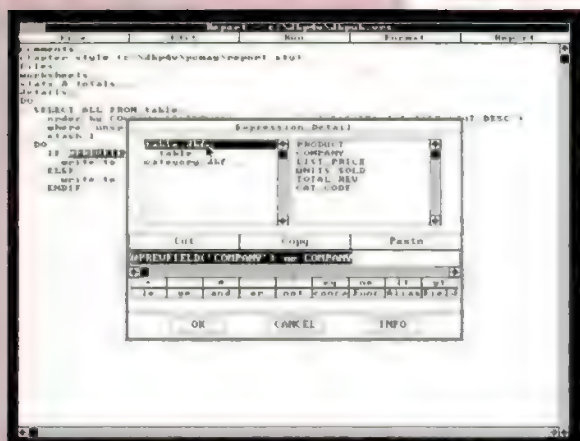


The KX-P2180, a 9-pin with color option. ATM not available.*



The KX-P2624, a 24-pin with ATM. Color option not available.*

PQ9-PC



In *dbPublisher for Ventura*, you select and manipulate data via Expression Detail dialog boxes, which allow you to build statements by clicking on the various syntax options. Clicking on certain options brings up further dialog boxes with lists of available functions.

even apply tags conditionally, based on the field's contents. In addition, you can embed *Ventura* typographical controls (conveniently listed in an appendix in the manual) and trailing text; embedding tab characters, for example, will get your text to line up in columns.

FUNCTION RICH

There are dozens of functions for everything from string manipulation to statistics. The program automatically creates formatted text files that result in *Ventura* tables, complete with headers. It also lets you use conditional logic to cause one set of fields to be written to the target file if a condition is true and another set if the condition is false (but you cannot use conditional logic when creating tables). About the only thing *dbPublisher for Ventura* can't do is import pictures automatically.

Once you have created the report format, you simply call and run it to produce a new text file. This makes it easy to update *Ventura Publisher* documents when your data file changes.

The big problem with *dbPublisher for Ventura* is that it is difficult to learn. There is a thorough print tutorial, a solid reference manual, and lots of useful and instructive ready-made templates included on-disk; but even so, this is not a program that you will pick up in an afternoon. You can set the program to automatically run Windows and *Ventura* and load your

document (or to run *GEM/Ventura*); this makes it relatively easy to test your report format as you work, which also helps the debugging process. But using this program is still a lot like programming.

DCS recognizes that not everyone is willing to—or needs to—become proficient at a program this complex. As a result, the company is

introducing the Instant Publishing Series, with *Instant Directory Publisher* as its inaugural product. This \$99 program comes with 35 preset directory formats, including mailing labels and 5- by 8-inch page formats that provide menu-driven publishing for .DBF files. These predefined formats include some sophisticated features, including initial letter and section headers and the ability to incorporate .PCX images as page logos.

There are programs that are easier to use, but few are in the same league when it comes to features for manipulating and processing data. If you work with *Ventura Publisher* and want to perform complex data manipulations, then *dbPublisher for Ventura* is worth consideration.

PAGEAHEAD SOFTWARE CORP.

PageAhead

Ease of use and power may seem like contradictory traits, but *PageAhead* proves that one package can give you both. With a list price of \$795, *PageAhead* Software's product is the most expensive in this group. But you may find *PageAhead*'s price to be justified: The program handles many difficult tasks with surprising ease and supports far more page layout application alternatives than the other products in this review.

PageAhead runs within Microsoft Windows, but this in itself does not guarantee ease of use. What makes this program a snap to use is its thoughtful design, which guides you through an overwhelm-

ing set of options while still providing rapid access to the features you use most often.

The program reads ASCII, *dBASE*, and *Oracle* files. The first step is to open a Query Table on your workspace, which presents a series of empty columns representing the different fields as defined in the data file's structure. You can then create a query by example (QBE), which is much like a selection statement using a *Paradox* database table; QBE also allows joins of database tables. To select only those records from California, for example, you enter "=CA" in the State column. Creating links between related data files is as easy as putting a common code in the corresponding columns.

The QBE format is really just a friendly front end to a SQL query feature, and you can toggle from one view to the other. You can edit a SQL query directly, though you cannot then revert to the QBE format without losing your changes. This feature lets you fine-tune a query; you can specify sorts, for instance. You also have a choice of other features to choose from, depending on the database file you use. For example, there are several functions you can apply to *dBASE* file data, and to make the sort go faster, you can also reference *dBASE* index files.

WORKING WITH THE WORK TABLE

After your query is complete, you choose the Query Now command, which produces an Answer Table (again, like the one in *Paradox*) and a Work Table. The Work Table displays the data in columns with a Ribbon and Toolbar similar to the latest versions of Windows word processors. There are options for Paragraph Style, Column Style, Font, Point Size, and Color. The Toolbar has buttons for 16 of the most commonly used commands and formatting features, such as the standard Bold, Italic, Small Caps, and Underline features.

The commands go much further than simple text formatting, however. The header/footer command allows you to group related rows, which can prevent the

printing of data that is repeated from the row before, such as the department name in an employee directory sorted by department. You can also perform computa-

SUITABILITY TO TASK PageAhead

Tables	■	■	■	■
Directories	■	■	■	■
Catalogs	■	■	■	



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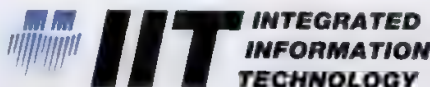
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CIRCLE 192 ON READER SERVICE CARD

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SUMMARY OF FEATURES

Products listed in alphabetical order

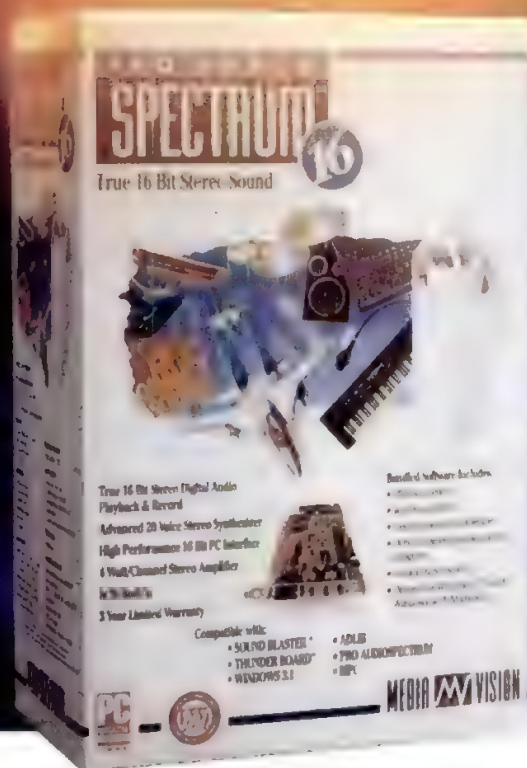


	DataPub	DataShaper	dbPublisher for Ventura	PageArmed	Ventura DataBase Publisher
List price	\$95.00	\$249.95	\$199.00	\$795.00	\$295.00
GENERAL FEATURES					
Environments available:					
DOS (character-based)	☒	☐	☐	☐	☐
Microsoft Windows	☐	☒	☐	☒	☒
Other	None	None	Proprietary	None	GEM
Interface:					
Function keys	☐	☒	☐	☒	☐
Pull-down menus	☒	☒	☒	☒	☒
Pop-up menus	☐	☐	☒	☐	☒
Keyboard shortcuts	☒	☒	☐	☒	☒
Icon bars	☐	☒	☐	☒	☒
Memory:					
Conventional RAM required	570K	20K	512K	640K	640K
Supports expanded memory	☐	☒	☐	☐	☒
Supports extended memory	☐	☒	☐	☒	☒
Disk space required:					
Minimal configuration	170K	68K	3MB	2MB	1MB
Standard configuration	170K	575K	3MB	4MB	1.65MB
Maximum display resolution supported	VGA	Windows-dependent	VGA	Windows-dependent	Windows-dependent
Supports mouse	☐	☒	☒	☒	☒
Batch processing	☐	☐	☐	☒	☒
Command line-based	N/A	N/A	N/A	☒	☒
Windows-based	N/A	N/A	N/A	☒	☒
Macro editor	☐	☐	☐	☐	☒
PAGE LAYOUT APPLICATIONS SUPPORTED					
Aldus PageMaker	☐	☒	☐	☒	☒
Ami Pro	☐	☐	☐	☒	☐
Interleaf 5	☐	☐	☐	☐	☒
Microsoft Word	☐	☐	☐	☒	☐
Microsoft Word for Windows	☐	☐	☐	☒	☐
Ventura Publisher	☒	☐	☒	☐	☒
WordPerfect	☐	☐	☐	☒	☐
WordPerfect for Windows	☐	☐	☐	☒	☐
INPUT DATA FORMATS					
DB2	☐	☐	☐	☐	☐
.DBF	☒	☐	☒	☒	☒
Delimited ASCII	☒	☒	☒	☒	☒
Comma-delimited	☒	☒	☒	☒	☒ (with conversion utility)
Tab-delimited	☐	☒	☐	☒	☐
Fixed-length	☒	☐	☒	☒	☒ (with conversion utility)
.NDX (dBASE)	☒	☐	☐	☒	☐
Oracle	☐	☐	☐	☒	☐
Paradox	☐	☐	☒	☐	☐
SYLK	☐	☐	☒	☐	☐
.WKx	☐	☐	☒	☐	☐
.XLS	☐	☐	☒	☐	☐
Multifile support	☐	☐	☒	☒	☐
AUTOMATIC FORMATTING AND LAYOUT OPTIONS					
Links with target application:					
Hot link or DDE server	☐	☐	☐	☒	☐
Warm link or Paste Link	☐	☒	☒	☒	☒
OLE	☐	☐	☐	☐	☐

N/A—Not applicable: The product does not have this feature.

CONTINUES

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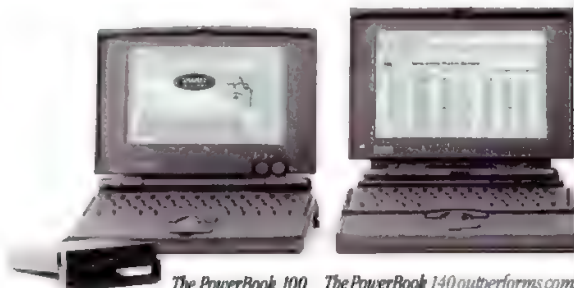
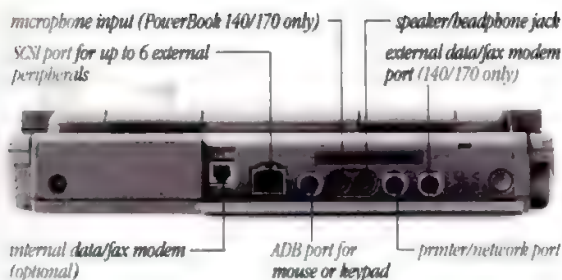
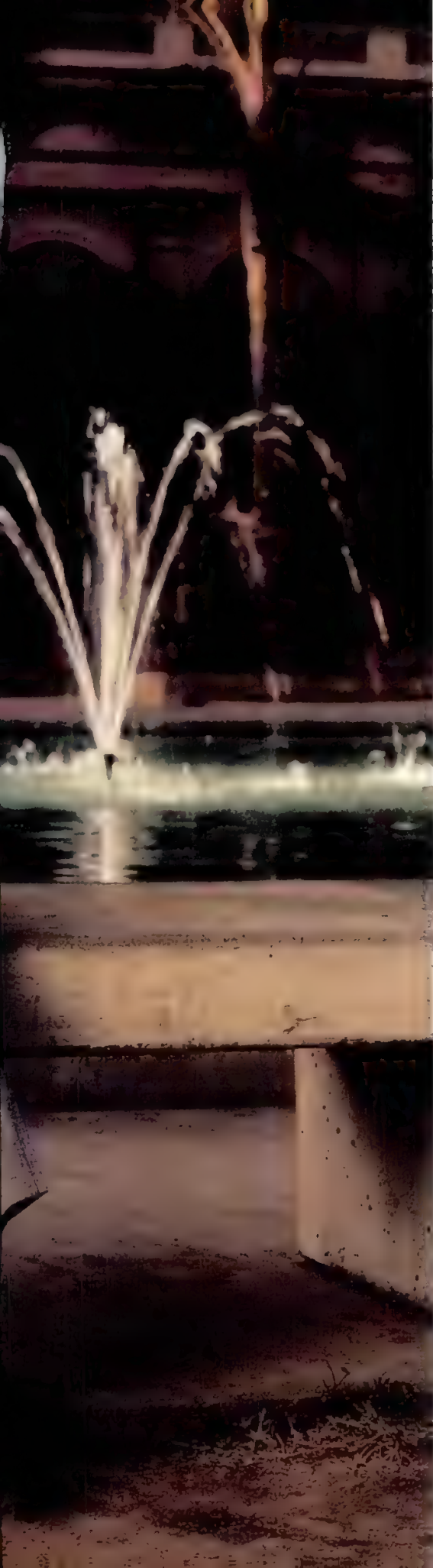


Media Vision, 47221 Fremont Boulevard, Fremont, CA 94538. 510-770-8600, FAX: 510-770-9592

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CIRCLE 093 ON READER SERVICE CARD





*The PowerBook 100 outperforms comparably configured 286 PCs running Windows 3.0.***

*The PowerBook 140 outperforms comparably configured 16 MHz and 20 MHz 386sx PCs running Windows 3.0.***



The AppleTalk® Remote Access software (included) gives you access to your Macintosh personal computer via phone line – so you can use all your files or e-mail, or an entire AppleTalk network, from wherever you are.



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PowerBook offers a new level of compatibility – its built-in Apple® SuperDrive™ disk drive reads from and writes to Macintosh and MS-DOS formatted disks. Add SoftPC and you can run MS-DOS programs, too. (You can even run MS-DOS and Macintosh programs at the same time.)

PowerBook	Weight	Memory	Hard Disk	SuperDrive	Processor	Internal Modem
100	5.1 lb.	2/4MB	20/40MB	Optional ext.	16 MHz 68000	Optional
140	6.8 lb.	2/4MB	40/80MB	Internal	16 MHz 68030	Optional
170	6.8 lb.	4MB	40/80MB	Internal	25 MHz 68030/ 68882 coprocessor	Optional

All PowerBook models expandable to 8MB RAM

For the name of your nearest authorized Apple reseller, call 800-4-A-APPLE ext. 700. *For an MS-DOS file, you need a file program like SoftPC and an Apple SuperDrive. Independent research by the International Business Machines Corporation has tested a variety of personal computers running applications available for both the Macintosh and Windows. Apple, Macintosh, and SuperDrive are trademarks of Apple Computer, Inc. MS-DOS is a registered trademark and Windows is a trademark of Microsoft.

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4. What does the installed user base say about my options?
5. Will it run on my LAN?
6. What tips and techniques can I learn to get more from the products I use?
7. If I buy a particular product now, is the manufacturer likely to be in business if I need help later?
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General Manager, Systems Software Marketing

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Technology Architecture Manager

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COMPUTER

LIBRARY™

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SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes □—No

DataPub	DataShaper	dbPublisher for Ventura	PageAhead	Ventura DataBase Publisher
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AUTOMATIC FORMATTING AND LAYOUT OPTIONS (continued)

Substitutions:				
Case substitution	☐	☐	☒ (some)	☒
Customizable sort order	☐	☐	☒	☒
Exact-match lookup table	☐	☐	☒	☒
Field-specific substitution	☐	☐	☒	☒
Substitution for missing data	☐	☐	☒	☒
Text-pattern substitution	☐	☐	☒	☐

Exceptions:				
Capitalization	☐	☐	☒	☒
Delimiters	☐	☐	☒	☒

TEMPLATES AND STYLES

Catalogs	☐	☒	☒	☐
Directories	☐	☒	☒	☐
Indexes	☐	☒	☒	☐
Mailing lists and labels	☐	☒	☒	☐
Tables	☐	☐	☒	☐
Tables of contents	☐	☒	☐	☐

Can use existing styles from target application:				
Character styles	☐	☒	☒	☒
Column styles	☐	☒	☒	☒
Document layout	☐	☒	☒	☐
Paragraph styles	☒	☒	☒	☒
Section styles	☐	☒	☒	☐
Border and shading styles	☐	☒	☒	☒
Tab styles	☒	☒	☒	☒

Can generate style for target application	☐	☒	☒ (default tags only)	☐
Can aggregate publications	☐	☒	☐	☐
Creates calculated columns	☐	☐	☒	☐
Cross-references	☐	☐	☒	☐

Concatenates fields:				
Entire fields	☐	☒	☒	☒
Substrings	☐	☐	☒	☒

Graphics:				
In-line	☐	☒	☐	☒ (with Interleaf)
Link graphics to fields	☐	☐	☐	☐
User can specify frame size	☐	☐	☐	☐

Typographical controls:				
Superscript and subscript	☒	☒	☒	☒
Double underline	☒	☒	☒	☒
Small caps	☒	☒	☒	☒
Strikethrough	☒	☒	☒	☒
Knockout text	☐	☒	☐	☐

Leading	☐	☒	☐	☐
Kerning	☐	☒	☐	☒
Tracking	☐	☒	☐	☐
Customizable line breaks	☐	☒	☒	☒
Widow and orphan control	☐	☒	☐	☒

QUERY FACILITIES

Supports database queries	☒	☐	☒	☒
Query language:				
dBASE-compatible	☐	N/A	☐	☐
SQL-compatible	☐	N/A	☐	☐
Proprietary	☒	N/A	☒	☒

N/A—Not applicable: The product does not have this feature.

* Only searches for records with exceptions, such as empty fields or 0 values.

CONTINUES

SUMMARY OF FEATURES

Products listed in alphabetical order

 Editors' Choice
☒ Yes ☐ No



DataPub	DataShaper	dbPublisher for Ventura	PageAhead	Ventura DataBase Publisher
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QUERY FACILITIES (continued)

Query interface:				
Command line	☐	N/A	☒	☒
Menu-driven	☒	N/A	☐	☒
Query by form	☐	N/A	☒	☒
Query by example	☐	N/A	☒	☐
Stores queries				
Nested select	☐	N/A	☒	☒
Background querying	☐	N/A	☒	☐
Maximum number of search fields	Unlimited	N/A	Limited by capacity of database filter	9
Search operators:				
AND	☐	N/A	☒	☒
Equal to	☐	N/A	☒	☒
Greater than	☐	N/A	☒	☒
Greater than or equal to	☐	N/A	☒	☒
Less than	☐	N/A	☒	☒
Less than or equal to	☐	N/A	☒	☒
NOT	☐	N/A	☒	☒
Not equal to	☐	N/A	☒	☒
OR (inclusive)	☒	N/A	☒	☒
Pattern match	☐	N/A	☒	☐
Search parameters:				
Case-sensitive	☐	N/A	☒	☐
User can specify number of occurrences	☐	N/A	☒	☐
Nested search	☐	N/A	☒	☐
Range	☐	N/A	☒	☐
Substring	☐	N/A	☒	☐
Wildcard	☐	N/A	☒ (first character only)	☐

FUNCTIONS AND OPERATORS

Aggregate functions:				
Average	☐	☐	☒	☐
Count	☐	☐	☒	☒
Date and time	☐	☐	☒	☐
Financial	☐	☐	☐	☐
Logical				
Maximum	☐	☐	☒	☐
Minimum	☐	☐	☒	☐
Subtotals	☐	☐	☒	☐
Totals	☐	☐	☒	☐
Mathematical functions				
Statistical functions:				
Standard deviation	☐	☐	☒	☐
Variance	☐	☐	☐	☐
String functions	☐	☐	☒	☒

DOCUMENTATION

On-line help	☐	☐	☒	☒
User manual	☒	☒	☒	☒
Reference manual	☐	☐	☒	☒
Printed tutorial	☐	☒	☒	☒
Sample files	☐	☒	☒	☒

N/A—Not applicable: The product does not have this feature.

ENDS

THE ONE DIFFERENCE BETWEEN MAKING A PAGE AND A DOCUMENT IS VENTURA.



Ventura Software Inc.

THE DOCUMENT MAKER

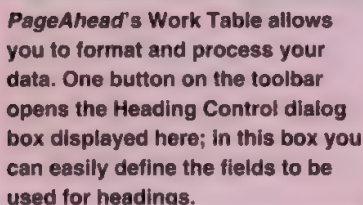
A Xerox Company



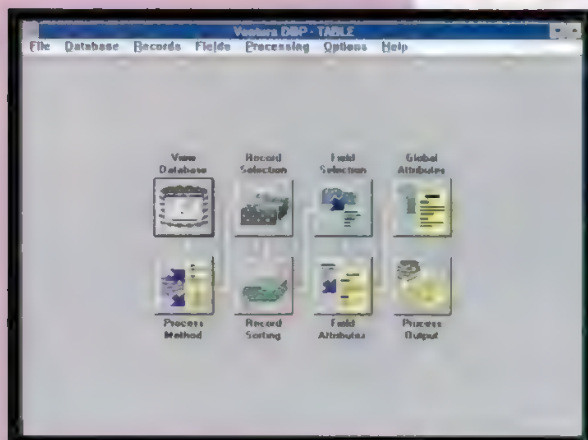
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CIRCLE 247 ON READER SERVICE CARD

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Created in Ventura Publisher 4.0 for Windows.



GRAPHICS DATABASE PUBLISHING



Ventura DataBase Publisher's main screen shows eight icons that provide access to the same commands available on the menus. The icons are arranged as a flowchart that guides you through the process of creating a "recipe" for processing a data file.

Ventura Publisher paragraph tag for the field, as well as text to be included before or after the field's contents. You can also embed codes such as line breaks, bold or italic font attributes, or special characters such as copyright or trademark symbols before or after text strings. Ventura DataBase Publisher displays a custom keypad where you can use the mouse to easily select these embedded codes.

Many dialog boxes include buttons that in turn open additional boxes. For ex-

ample, when working with the Field Attributes box, you can select additional options that cover text and number formatting, heading selections, and substitution dictionaries.

After the program writes the output file, the dialog box offers an option to view the output. Selecting this option does not give you a complete picture of how the file will look when formatted, but it does let you see the text file with its embedded codes so you can get a good idea of whether or not you got the results you intended. Ventura DataBase Publisher also has a handy command on the File menu that will automatically run Ventura Publisher and load your chapter. The program cannot create style sheets or chapters, but it can reference them after they have been created and saved within Ventura Publisher. It can also format the output file as either a text stream for Ventura or a Ventura table.

SUITABILITY TO TASK				
Ventura DataBase Publisher				
Tables	■	■	■	■
Directories	■	■	■	■
Catalogs	■	■	□	□

THE POWER AND THE OMISSIONS

There are many powerful details hidden within those simple steps, but there are some important omissions as well. One of the program's shortcomings is its inability to use dBASE index files, which means that all sorts must be performed from scratch every time you process a file. It also lacks dynamic data exchange (DDE) support, which means that you must export your text file each time the data changes, and it cannot place pictures automatically. And you can only reference one .DBF file at a time, so you cannot perform lookups between tables.

On the other hand, Ventura DataBase Publisher offers some handy workarounds to these problems. For example, the program has a sophisticated replacement dictionary feature that you can use for a variety of text pattern-matching tasks, replacing all of a field's contents or just words within the field. You can also use dictionaries to control automatic capitali-

zation or to customize sort orders and lookup replacements.

The program includes a dictionary table editor that makes easy-to-create short lists and that can quickly generate dictionaries from .DBF files. You select any two fields from a .DBF file, and the program creates a dictionary file that you can use for lookup replacements. You can even sort the data based on the replaced value. This means that you can create a dictionary from a client table that lists the client code and name, which can then be used to replace the client code with the client name when generating billing information. Aside from requiring the extra step of creating a dictionary for each lookup field (which must be recreated every time you add a new client), Ventura DataBase Publisher limits you to nine dictionaries per recipe—a limitation you could bump up against with just a moderately complex publishing task.

While it can take some time to master, the dictionary feature has the potential to be a powerful tool. There are more than 70 different functions at your disposal, which can be used to trigger special formatting codes such as starting a new page when a field starts with a different letter than the previous record—handy when creating directories or catalogs. Other functions cover features such as counters, text formatting, and widow and orphan controls.

The package comes with runtime utilities for both Windows and DOS that allow you to process a data file but not modify the Ventura DataBase Publisher recipe. Unfortunately, the licensing for these utilities is the same as for the total package, so you can only run them on the same system where the full program is installed.

Ventura DataBase Publisher represents an attractive value. This is a solid and useful program that is relatively easy to use, especially in terms of accessing the fundamental features. Its limitations are not likely to cause major problems for most users. And it does have some sophisticated features for more complex formatting tasks, though you will need to invest some time in order to master them. ■

Rick Ayre is a project leader at PC Magazine Labs. Alfred Poor is a contributing editor to PC Magazine.



Ventura DataBase Publisher

Ventura Software Inc., 15175 Innovation Dr., San Diego, CA 92128; 800-822-8221, 619-673-0172.

List Price: \$295.

Requires: 286-based PC or better, 1MB RAM, EGA display, Microsoft Windows 3.0 or later, mouse, 2MB RAM recommended.

In Short: Ventura DataBase Publisher falls midfield in terms of price, features, and ease of use—a combination that should make this package particularly attractive to those looking to perform relatively straightforward tasks easily and affordably.

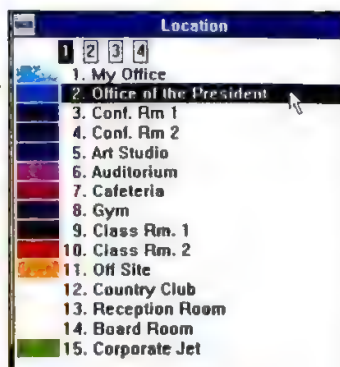
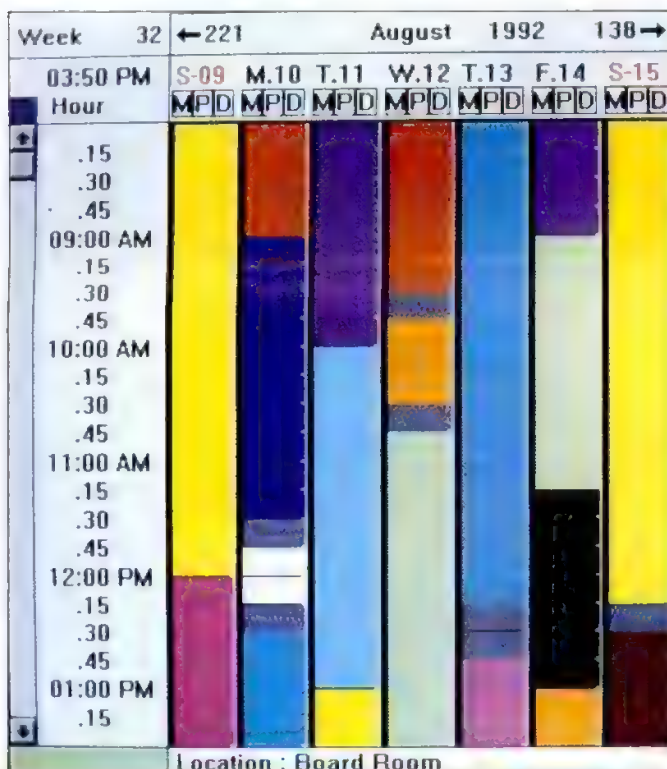
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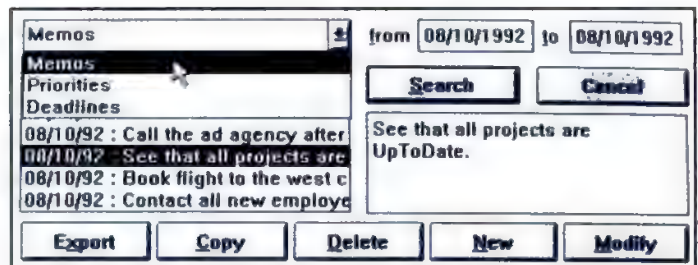
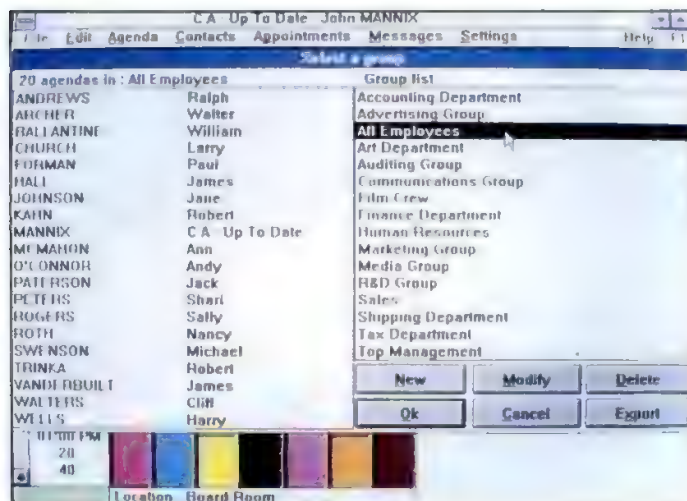
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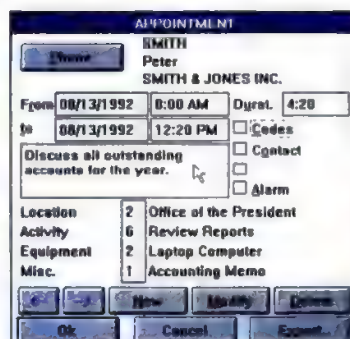
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Xbase Development Systems



PHOTOGRAPHY: THOM ITCOMMER

From their
humble beginnings
as dBASE-compatible
packages, Xbase
systems have
developed a life
of their own.

Alive and Better Than Ever

by Sal Ricciardi

If you're an Xbase developer today, life is good. The products are getting better and faster, and the industry spawned by *dBASE II* is prospering. With the acquisition and dismembering of Ashton-Tate Corp. by Borland International, and Microsoft's announced intention to acquire Fox Software, a newfound hope, strength, and optimism have emerged. The two companies bring a tremendous wealth of language expertise to the Xbase language arena, along with a commitment to furthering and enhancing the future of Xbase.

WHITHER XBASE?

The term *Xbase* first became popular in 1990 as a way to describe the family of products bearing some resemblance to the *dBASE* language without actually using the name *dBASE*. While initially an

aborted attempt at a language standard and a ploy to avoid Ashton-Tate's then-aggressive legal team, it has now become accepted as the best way to characterize the segment of the industry that includes multivendor *dBASE*-compatible or *dBASE*-style database management systems and all of the supporting products and services. The term *Xbase* has a measure of vendor independence and thus reflects the generic standard that the language has become.

The five Xbase development systems reviewed here are *Clipper*, Version 5.01; *dBASE IV*, Version 1.5; *dBFast for Windows*, Version 1.7C; *dBMAN V for MS-DOS*, Version 5.31; and *FoxPro*, Version 2.0. They all have a common genesis in the *dBASE III Plus* language, but each product has extended and improved on the base language in different ways. Each product also reveals strengths that help differentiate it from its peers.

FoxPro, for example, has a wonderful multiwindow development environment that lets you build character-based mouse-compatible controls into your applications. *Clipper* has object-oriented language extensions, an open architecture, and strong third-party support. *dBASE IV* and *dBMAN V* both provide strong cross-platform opportunities, while *dBFast for Windows* is the only product reviewed here that creates Windows applications.

Five years ago, choosing an Xbase development product meant looking for the product that was most compatible. These days your best choice is the one whose strengths most closely match your applications' requirements and your development philosophy.

WHY XBASE?

While accurate statistics are hard to come by, the number of applications developed in some form of Xbase is certainly very large. Why is Xbase so successful? Several features make it an attractive development platform.

Xbase is a high-level language designed for producing business applications. Operations that typically require many commands in another language can be executed quite simply in Xbase. For example, in Xbase you don't have to be aware of the physical structure of your data as you would with a general-purpose programming language. Simply opening a database file with the *USE* command automatically allocates buffers for storage and makes the contents of the fields in

the first record available. To change the value in a field, you simply replace your field with a value; Xbase takes care of the physical details. Hiding the physical implementation is a basic function of a database management system.

The Xbase language includes built-in support for indexes, making fast access to large amounts of data possible—a requirement for most business applications. The commands that operate on the database are represented in English-like syntax, making them easy to understand and program. Many commands have a scope option, which lets you operate on a range of rows or on the entire database with a single statement; this feat requires much more effort in a general-purpose language.

Many business applications require calculations using dates and involve some form of data entry. Xbase includes a *date* data type and automatically supports date calculations, which is useful for aging your accounts receivable, for example. For full-screen data entry, a standard method of entering and editing data using the *@...SAY* and *@...GET* commands is

supported in every product reviewed here.

The point is that the Xbase language has built-in support for all of the most common requirements for business applications. This makes it possible to build new systems quickly and cost-effectively and makes maintenance easier. Since all of the Xbase vendors support a base language, the core of which is based on *dBASE III Plus*, a large amount of your Xbase expertise is leveraged between products.

The vendors distinguish their products by extending the *dBASE III Plus* core language. Each product in this review supports at least those capabilities mentioned above, and they all go beyond that in some fashion. For example, *dBASE IV*, *dBFast*, *dBMAN V*, and *FoxPro* include support for some form of windowing, although the vendors approach this in different ways. Both *dBASE IV* and *FoxPro* support a multiple-entry index file format, which lets you combine what would otherwise be many single index files. *FoxPro* and *dBFast* include support for controls like push buttons and radio buttons (*FoxPro* in character-mode DOS and *dBFast* under Microsoft Windows).



RATING THE PRODUCTS: SUITABILITY TO TASK

***FoxPro* is the hands-down winner for both the breadth and the depth of its tools, but *Clipper* is endowed with a very capable, extensible development language.**

Designing and prototyping evaluates the product's ability to assist in the design and prototyping phase of applications development. The score rates the screen, menu, and query design facilities as well as database- and index-maintenance functions for completeness and ease of use. This task also examines the development environment for integration and ease of use.

Report generation evaluates the program's report design and creation facility. It assesses the ability to design and to create free-form and column-based reports; this includes group totals, calculated fields, built-in functions, user-defined functions, summary reports, and sending the report to the screen, file, or printer.

Extending and interfacing examines the product's ability to extend its base functionality with custom routines via a clearly defined and well-supported external API.

Development and distribution evaluates the product's language features and extensions for utility and completeness. Considerations include the language support provided and the relative ease with which you can design and code a one-to-many form for a custom application. The score also assesses support for memory management via a virtual memory scheme, support for extended/expanded memory, and support for debugging and project management. Finally, it rates the ability to distribute an application easily via a free-standing .EXE or runtime facility.

SUITABILITY TO TASK	
Product Name	
Designing and prototyping	● ○ ○ ○ ○
Report generation	● ● ○ ○ ○
Extending and interfacing	● ● ● ○ ○
Development and distribution	● ● ● ● ○

- 1—Poor
- 2—Satisfactory
- 3—Good
- 4—Excellent

IS XBASE RELATIONAL?

Students of database theory will find the word *relational* missing from my brief description of the Xbase language. The reason is simple: Xbase products do not conform to E. F. Codd's relational model, as defined in his book *The Relational Model for Database Management*, Version Two (Addison-Wesley). If an Xbase product is called relational, the vendor is probably using the old and incorrect notion that any database capable of handling multiple tables is relational. This simply is not true. For example, the relational model specifies integrity constraints that help maintain the correctness and validity of data stored in a database. In a relational database, a database administrator will specify these rules as part of the database definition. Thereafter, the integrity rules are enforced by the database engine globally, whether a user is accessing the data interactively or programmatically through a custom application. In this sense, it is said that the integrity controls exist at the database level instead of at the program level.

In all of the products reviewed here, the enforcement of integrity constraints can only be accomplished programmatically. This is one example of an area where the Xbase category of database management systems differs from the relational model. While this doesn't mean you cannot create a robust application using Xbase, it does mean that you'll benefit from the skills of a professional Xbase developer, especially one who understands the benefits of many of Codd's rules.

While no PC database product fully qualifies as relational, as in Codd's definition, the major software vendors—including Borland International and Fox Software—are building more relational features into their products. Borland and Fox have implemented some form of structured query language (SQL), for example, and both are migrating their products in the direction of supporting greater relationality.

REVIEW CRITERIA

For this evaluation we looked for Xbase development products that are largely *dBASE III Plus*-compatible and provide a method of distributing custom applications to users who don't own the products. Two of the products, *Clipper* and *FoxPro*, let you create standalone .EXE files for distribution. The other three—*dBASE IV*,

dBFast for Windows, and *dBMAN V*—support a runtime mechanism where you compile your application to a tokenized format and distribute it along with special runtime files. *FoxPro* also supports optional runtime distribution.

We requested copies of WordTech's *Arago* and *Quicksilver* for review. *Arago* didn't ship in time to meet our testing deadline, but it is reviewed in the First Looks section of this issue. WordTech chose not to submit *Quicksilver*. Dvorak Software Development's *Force* is not included here because the language is not sufficiently *dBASE III Plus*-compatible. Emerald Bay Groups chose not to submit *Vulcan*.

CURRENT FEATURES, FUTURE TRENDS

All of the review packages allow you to distribute your applications without requiring users to own the product. *Clipper* (\$795) and *dBFast for Windows* (\$550) are the only products that include the

unlimited distribution capability straight out of the box. *dBMAN V* (\$350) requires that you purchase either a single-user (\$300) or multiuser (\$500) runtime license. The unlimited runtime module of *dBASE IV*, Version 1.5 (\$795), costs an extra \$250, while *FoxPro* (\$795) requires the \$500 *FoxPro Distribution Kit*.

Two of the products—*FoxPro* and *dBASE IV*—provide a facility for prototyping and constructing queries. *FoxPro*'s relational query by example (RQBE) constructs a SQL SELECT statement, while *dBASE*'s query by example (QBE) generates *dBASE* procedural code to perform the query. *FoxPro*'s method performs better because the SQL SELECT statement is nonprocedural, which means that it doesn't specify how *FoxPro* should perform the query. This allows *FoxPro*'s adaptive query optimizer to choose the best and fastest method for a given query. On the other hand, *dBASE IV*'s fill-in-the-blanks-style QBE makes it easier to specify the query.

Both *FoxPro* and *Clipper* support ex-



EDITORS' CHOICE

- *Clipper*
- *FoxPro*

Out of the five Xbase development packages reviewed here, two are worthy of *PC Magazine*'s Editors' Choice award: *FoxPro*, Version 2.0, and *Clipper*, Version 5.01.

FoxPro, from Fox Software, has the strongest combination of features, flexibility, and performance. We were impressed by its speed and its excellent development environment, as well as its enabling technology. You can build modern-looking event-driven programs that support a mouse without leaving the *FoxPro* environment—and without calling on third-party tools. It offers every popular application distribution option and has an API for writing your own extensions. In addition, *FoxPro*'s Rushmore data access technique provides you with opportunities to speed up your programs dramatically.

A cursory glance at our Suitability to Task ratings will give you the wrong idea about Nantucket Corp.'s *Clipper*. While *Clipper* isn't strong in all areas, it is very strong in the area that matters the most to devel-

opers: power and flexibility, thanks to its language innovations and open architecture. *Clipper* offers lexically scoped variables for more robust programs, highly customizable object classes such as TBROWSE, the ability to add new commands to the language, and more.

In addition, its well-defined API has spawned extensive third-party, add-on library support. It's not the best choice if you don't have your own tools, but for serious development work you'll find it very capable. *Clipper* also did very well on our performance tests, beating *FoxPro* on two of the three Mixed Workload throughput tests.

Borland International's *dBASE IV*, Version 1.5, has improved, but it doesn't compare well with *FoxPro*'s development environment and tools or with *Clipper*'s language improvements and open architecture. *dBASE IV*'s strong point is its cross-platform support. If you are developing applications that must run on more than one of its supported platforms, it merits consideration.

ternal APIs that let you add new routines written in C or assembler. *Clipper's* Extend System interface has encouraged a large third-party market and comes with the product at no extra charge. *FoxPro's Library Construction Kit* costs \$500, but it provides documented access to much of *FoxPro's* own internal routines so that you can create and manipulate windows and chain into *FoxPro's* event loop. *dBFast for Windows* offers access to Windows .DLLs and is the only product we reviewed that produces Windows applications.

Clipper evidences a trend toward bringing more traditional, general-purpose language features into the Xbase fold. For example, *Clipper* supports lexically scoped variables, a feature familiar to C programmers but unusual for Xbase until now. Lexical scoping helps you protect variables from outside influences, since you can rigidly define variable lifetime and visibility. This helps promote more reliable code and is a welcome advancement.

If there's one feature that differentiates these products, it's the user interface. *FoxPro's* development environment is excellent; all of the others are mediocre in comparison. Both Borland and Nantucket Corp. are working on better IDEs for future products.

OBJECTED-ORIENTED FUTURE?

Clipper, although not an object-oriented language, is the first Xbase product to introduce objects into its language implementation. *Clipper*, Version 5.0, includes several standard built-in object classes. Nantucket promises to expand on *Clipper's* object-oriented capabilities in the next release by more fully supporting object-oriented programming and by allowing the creation of user-defined object classes. The touted benefits of object-oriented programming are faster development of more robust applications with reduced maintenance costs.

Borland is not silent on this issue either. With *dBASE for Windows* expected to ship later this year, Borland intends to provide features such as the ability to define and attach methods to objects. In addition, *dBASE for Windows* will offer a completely new development environment and support for standalone .EXEs, along with the ability to create Windows applications.

Fox Software has announced its intention to release *FoxPro for Windows*, a port

of the DOS version to the Windows environment. According to Fox officials, the planned merger with Microsoft will not delay or otherwise affect that release. However, given Microsoft's strengths in building Windows applications, it's likely that later versions of the product will benefit from Microsoft's expertise.

With these promising future developments, one thing appears certain: Xbase is here to stay. If you're looking for an Xbase development product, the reviews that appear on these pages will help you pick a winner.

All reviews by Sal Ricciardi

Clipper

Nantucket Corp.'s \$795 *Clipper*, Version 5.01, stumbled out of the starting gate, but like a horse with a late kick has been gaining ground ever since. Xbase regulars will recognize *Clipper* as one of the original *dBASE* compilers, offering the ability to compile an application to a single, easily distributable .EXE file. Still a traditional two-step compiler, *Clipper* offers the same ease of distribution as well as many of the language enhancements that have brought Nantucket a loyal following and a reputation for language innovation.

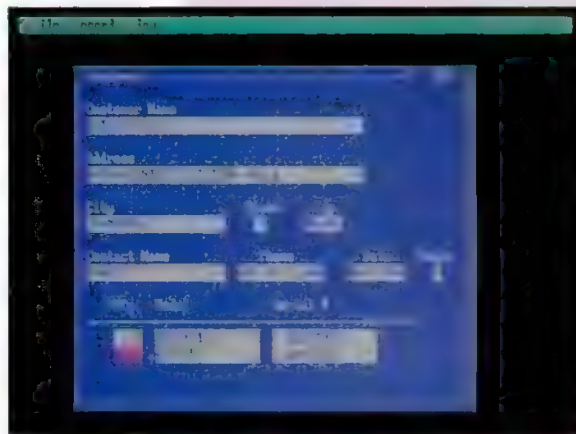
The package includes the *Clipper* compiler, a custom version of Pocket Soft's *RTLlink* linker, a debugger, a MAKE utility, a number of utilities written in *Clipper*, and some sample source code. To produce a program using *Clipper* you first prepare your source code using a text editor and compile it using the *Clipper* compiler, which produces an object file. You then link the object file with the *Clipper* libraries to produce a free-standing executable file.

Since *Clipper* cannot be used interactively, it doesn't support some of the commands you might expect from a *dBASE*-style interactive product, such as ASSIST, DISPLAY MEMORY, EDIT, and so on. There is no packaged development environment. You won't find

lots of design tools or code generators, since *Clipper* is a straightforward two-step language compiler. However, several utilities are provided to give barebones support for certain needs. For example, PE, a simple editor written in *Clipper*, is meant more as an example of how to include an editor in your code or as a do-or-die emergency editor than as a replacement for your favorite. Similarly, *Clipper's* report writer (RL) has its genesis in *dBASE III Plus* and can't compare to the likes of *FoxPro's* report writer, or even *dBASE IV's*. For the most part, *Clipper* developers use the product for what it was meant to be: a language compiler that can easily be supplemented with a suite of tools and libraries provided by other vendors. For example, *R&R Report Writer*, a third-party product from Concentric Data Systems, is often used to design and produce reports.

Indeed, *Clipper's* biggest claim to fame is its flexibility and open architecture. You can add the necessary functionality by building libraries of routines using C, assembler, or any other language that produces standard .OBJ files and can interface to the *Clipper* Extend System—Nantucket's external interface. The Extend System was first introduced in 1986 and has helped *Clipper* acquire a huge third-party following.

The open-architecture approach evidenced by the Extend System is apparent in other aspects of the product as well. Nantucket was the first company to introduce the idea of User Defined Functions



Clipper's TBROWSE class provides a highly customizable tool with which you can browse any type of tabular data. Here, a TBROWSE is used in a one-to-many form.

dBASE IV COMPILER PROMISED



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(UDFs) to the Xbase repertoire, a feature since adopted by just about every other Xbase vendor. *Clipper* 5.0 introduced a new idea called User Defined Commands (UDCs). Whereas UDFs give you the ability to add to *Clipper*'s suite of built-in functions, UDCs let you add new commands to the language. In fact, since most of *Clipper*'s own commands are implemented through UDCs, you can change the language to be almost anything you want it to be. For example, at the time of this writing, Nantucket was preparing to release the *Professional Compiler Kit for dBASE IV*, which uses UDCs to add *dBASE IV*-compatible commands to *Clipper*.

User-defined commands are implemented through *Clipper*'s preprocessor, which also supports conditional compilation, file inclusion, and manifest constants. The capabilities of the preprocessor are evidence of *Clipper*'s evolution toward including more traditional high-level language features.

TOOLS FOR LINKING AND DEBUGGING

Clipper's edit/compile/link/debug cycle can be tedious and time-consuming compared with an interpreter, but it's made more reasonable by two tools included with Version 5.01. The overlay linker, RTLink, supports incremental linking and prelinked libraries. A prelinked library is a collection of routines that are linked ahead of time and stored in a separate .PLL file. The .PLL file is then combined with the executable code at runtime instead of at link time. This can dramatically reduce link time when developing an application, and thus reduce the amount of time spent in the cycle.

The second helpful feature is *Clipper*'s new debugger. It is greatly enhanced over previous versions and includes the ability to single-step, set breakpoints, watch and change variables, and so on.

Clipper's language enhancements are many. The product supports lexical scoping (locals and statics), which gives you more control over variable visibility and lifetime and encourages more robust programs. You can also declare a function as static, which restricts its usage to the source file in which it was defined. This lets you use the same function name in more than

one source file without naming conflicts. *Clipper* supports true multidimensional ragged arrays that can be dynamically resized at runtime.

Nested arrays are supported: An array element can itself contain a reference to another array. A new data type called a *code block* lets you create compiled code snippets that can be passed around just like data—assigned to a variable, returned from a function, and so on. This lets you

build very general procedures that can be easily customized by passing code blocks as parameters and having the called function evaluate (execute) the code block. The code blocks themselves can accept parameters.

A LEAP TOWARD OBJECTS

Version 5.01 is the first release to evidence Nantucket's move towards object-oriented technology. Several predefined object classes are included. For example, a TBROWSE object permits browsing of any form of tabular data, including arrays and text strings as well as database fields. You can customize the retrieval of data, allowing for scoped and filtered browses. You have full control over every keystroke and can even create a pull-down menu system using TBROWSE. The possibilities for customization seem infinite.

The same can be said of the GET object. The GET class is *Clipper*'s implementation of the traditional @...GET form of data entry. Here, too, you have full control over every keystroke and can modify the GET subsystem to your heart's content. An ERROR class lets you customize the way errors are handled. Learning how to use the new objects will prove daunting to those who are currently unfamiliar with object-oriented concepts, but the functionality provided is welcome indeed.

The *Clipper* language proper is highly compatible with *dBASE III Plus*, but it makes no attempt at all to be *dBASE IV*-compatible (for this you'll want the *Professional Compiler Kit*). *Clipper* is less a *dBASE* clone these days and more a general-purpose language that happens to make use of your Xbase expertise. This

distinction is likely to become even more marked in the future.

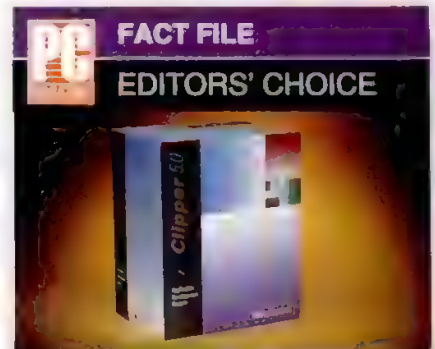
Network support is included out of the box; there's no special LAN version or LAN pack required. The standard record- and file-locking functions are included, along with sample source code showing you how to use them. More important to serious network developers is the availability of several third-party libraries that go well beyond *Clipper*'s native network support.

For example, NetLib, a popular library from Pinnacle Publishing (Federal Way, Washington), provides extensive support for *NetWare*, including Novell's Transaction Tracking System. Other libraries are available that let you use *Clipper* with server-based products.

When you purchase *Clipper* you get an unlimited license to distribute the .EXE files you create with it. There's no extra-cost runtime or distribution kit required. On PC Magazine Labs' performance tests, *Clipper* acquitted itself quite well, finishing first on the Mixed Workload throughput tests with concurrent random read and writes. It finished behind *FoxPro* and *dBASE IV* on the Load and Index tests, however.

Clipper is a very flexible, open-architecture development system that suffers only from the near-total absence of a development environment and design tools, which is not likely to deter a programmer. It's supported by a rich selection of third-party add-on products, and its high level of support for customization makes it the only possible choice for working with certain applications and environments.

SUITABILITY TO TASK	
Clipper	
Designing and prototyping	● ○ ○ ○
Report generation	● ● ○ ○
Extending and interfacing	● ● ● ●
Development and distribution	● ● ● ●



Clipper, Version 5.01

Nantucket Corp., 12555 W. Jefferson Blvd.,
Los Angeles, CA 90066; 213-390-7923.

List Price: \$795.

Requires: 512K RAM, DOS 3.1 or later.

In Short: *Clipper*, Version 5.01, is a powerful and flexible system for database applications development. But while it has many interesting and useful language extensions, it lacks an IDE and design tools.

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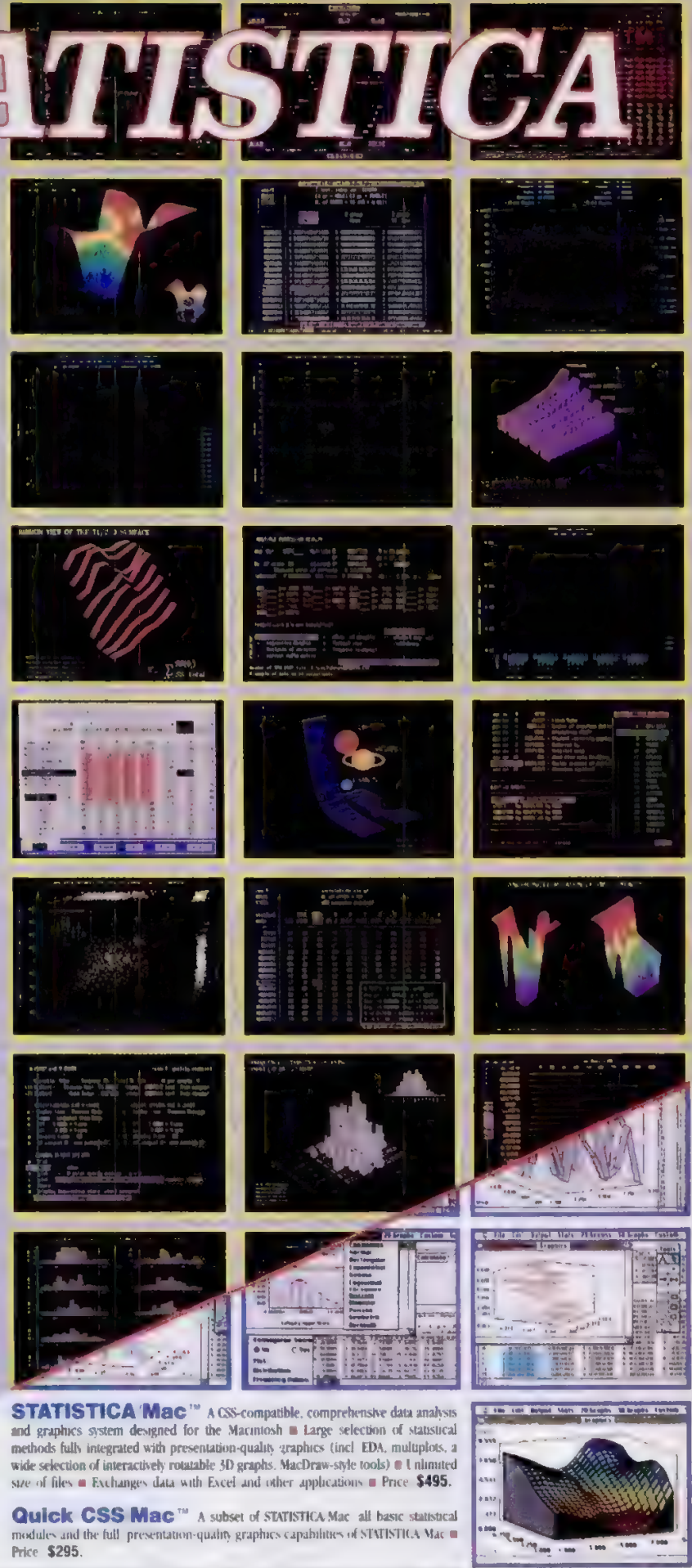
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CIRCLE 059 ON READER SERVICE CARD FOR MAC

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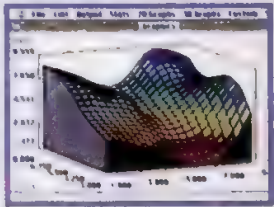
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SUMMARY OF FEATURES

Products listed in alphabetical order

☐ —Editors' Choice
☒ —Yes ☐ —No

	Clipper	dBASE IV	dBFast for Windows	dBMAN V for MS-DOS	FoxPro
List price	\$795	\$795	\$550	\$350	\$795
GENERAL FEATURES					
Environment	DOS	DOS	Microsoft Windows	DOS	DOS
Disk space needed for full installation	6MB	8MB	2MB	1.5MB	12MB
Expanded memory support	☒	☒ (with disk cache)	☒	☒	☒
Extended memory support	☐	☒ (with disk cache)	☒	☒	☒
Includes disk cache	☐	☒	☒	☒	☒
DATA LIMITS					
Maximum number of:					
Records per database	1 billion	1 billion	2 billion	2 billion	1 billion
Fields per record	1,000	255	128	256	255
Indexes per multiple-index file	None	47	None	Unlimited	Unlimited
Open database files	250	40	25	50	25
Open index keys per database	15	470	Unlimited	Unlimited	Unlimited
Maximum size of:					
Records (in bytes)	8,000	4,000	4,000	8,000	4,000
Character fields (in bytes)	254	255	250	254	254
Memo field	64K	64K	64K	64K	Unlimited
COMPATIBILITY					
Compatible with dBASE III Plus language	☒	☒	☒	☒	☒
Compatible with dBASE III Plus .DBF format	☒	☒	☒	☒	☒
Uses dBASE III Plus .NDX index format	☒ (with driver)	☒	☒	☐	☐
Compatible with dBASE IV language	☐	☒	☐	☐	☒
Compatible with dBASE IV .DBF format	☐	☒	☐	☐	☒
Uses dBASE IV .MDX index format	☐	☒	☐	☐	☐
Can use proprietary index format	☒	☐	☐	☒	☒
COMPATIBLE NETWORK OPERATING SYSTEMS					
NetWare	☒	☒	☒	☒	☒
LAN Manager	☒	☒ (limited)	☒	☒	☒
VINES	☒	☒ (limited)	☒	☒	☒
PC LAN	☒	☒	☒	☒	☒
3+Open	☒	☒	☒	☒	☒
LOCKING FEATURES					
Explicit	☒	☒	☒	☒	☒
Field	☐	☐	☐	☐	☐
File	☒	☒	☒	☒	☒
Implicit	☐	☒	☒	☒	☒
Record	☒	☒	☒	☒	☒
INTERACTIVE OPERATIONS					
Query by example (QBE)	☐	☒	☐	☐	☒
Interactive SQL queries	☐	☒	☐	☐	☒
Saved filters	☐	☒	☐	☐	☒
Saved relations	☐	☒	☐	☐	☒
Interactive applications generator	☐	☒	☐	☒	☒
SCREEN AND FORM CREATION					
Check boxes	☐	☐	☐	☐	☒
Interactive painter	☐	☐	☐	☐	☐
Mouse support	☐	☐	☐	☐	☒
Pull-down menus	☐	☒	☐	☒	☒
Push buttons	☐	☐	☐	☐	☒
Radio buttons	☐	☐	☐	☐	☒
Test mode	☐	☒	☐	☒	☒
Can attach code to screen objects	☐	☒	☐	☐	☒

CONTINUES

He was

the most incredible
specimen of manhood
Jennifer had ever seen.

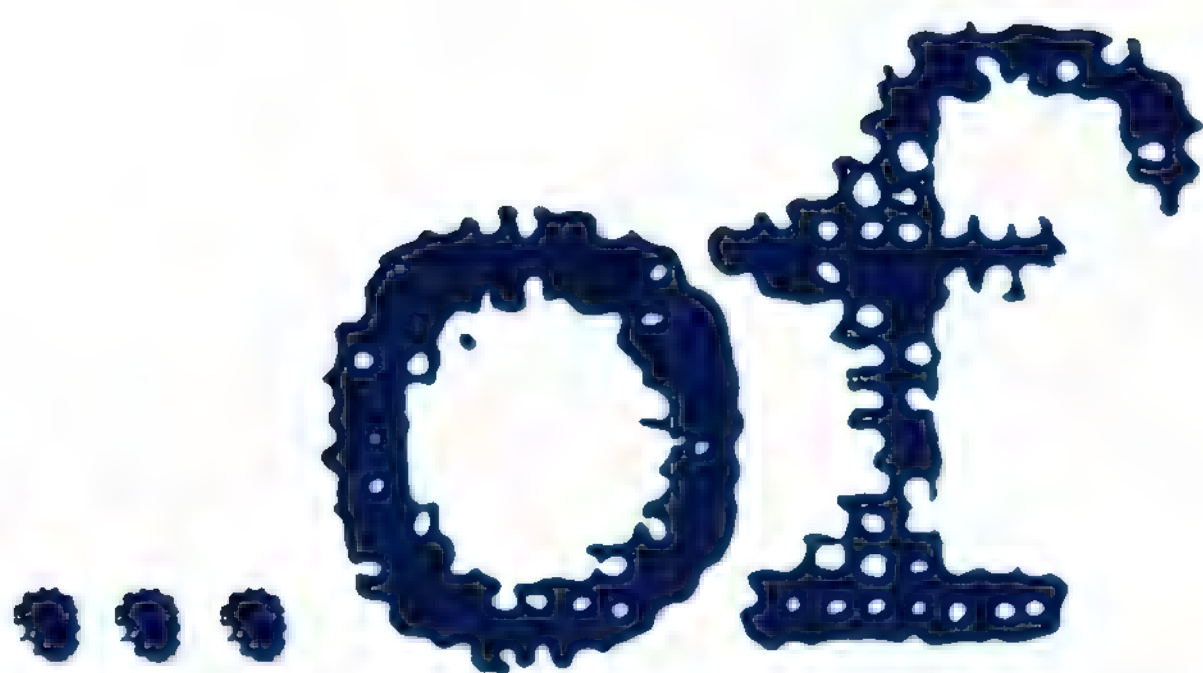
And

under that crisp white cotton shirt
and faded blue jeans, she could
tell he had a physique any sane
woman would die for.

For

a moment she lost herself in
fantasy, wondering if, at last, she
would meet the man who could
satisfy her hunger...one who
would share her dream...





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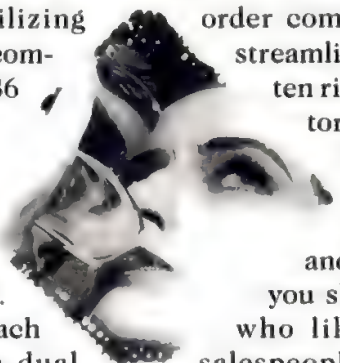
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• Built-in mouse trackball

Big features, little box. That's the Express 325 NXL. With extra power on the road—and in the office, too—it comes with everything you want in a notebook. And more. And it weighs less than six pounds.

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- Sleep button • AC wall adapter • \$2,095

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Express 333

LOW PROFILE • 386 DX rated at 33MHz • 4MB DRAM expandable to 32MB • 32KB cache • 80MB hard drive • Dual floppy drive, containing 5.25" 1.2MB and 3.5" 1.44 MB high-density diskette drives • 3 full-size 16-bit and 2 half-size 8-bit slots • HRVGA monitor (1024 x 768) • 80387 math coprocessor socket • 1 parallel port and 2 serial ports • DR DOS 6.0 • \$1,795



Express 325s

LOW PROFILE • 386SX rated at 25MHz • 4MB DRAM expandable to 16MB • 40MB hard drive • Dual floppy drive, containing 5.25" 1.2MB and 3.5" 1.44MB high-density diskette drives • HRVGA monitor (1024 x 768) • 3 full-size 16-bit and 2 half-size 8-bit slots • 80387SX math coprocessor socket • 1 parallel port and 2 serial ports • DR DOS 6.0 • \$1,295

Express 433

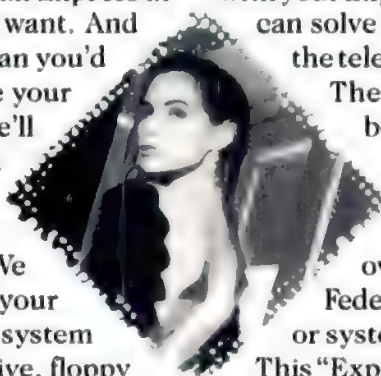
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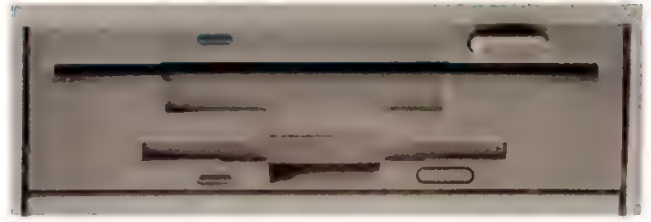
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SUMMARY OF FEATURES

Products listed in alphabetical order

 —Editors' Choice

☒ —Yes ☐ —No


Clipper

dBASE IV^{*}

dBFast for Windows

dBMAN V for MS-DOS

FoxPro

OBJECTS SUPPORTED BY LANGUAGE

Check boxes	☐	☐	☒	☐	☒
Push buttons	☐	☐	☒	☐	☒
Pull-down menus	☐	☐	☒	☐	☒
Radio buttons	☐	☐	☒	☐	☒
Other objects	GET, TBROWSE	Pop-up menus	Hotkeys, list boxes, picture buttons, screen sensitivity	Horizontal, vertical, scrollable menus	Pop-up menus, scrollable lists

REPORT CREATION

Tabular report format	☐	☒	☐	☒	☒
Free-form report format	☐	☒	☐	☒	☒
User-definable printer initialization	☐	☒	☐	☒	☒
User-definable functions used as fields	☐	☒	☐	☐	☒
Allows multiple fonts in a report	☐	☒	☐	☐	☐
Mouse support	☐	☒	☒	☐	☒
Test mode	☐	☒	☐	☒	☒

LABEL CREATION

Number of preset label sizes	5	9	None	3	8
User-definable label sizes	☒	☒	☒	☒	☒
Allows multiple text styles on a label	☒	☒	☐	☐	☐
Test mode	☒	☒	☐	☒	☒

PROGRAM EDITOR

Mouse support	☐	☐	☒	☐	☒
Allows multiple open program files	☐	☐	☒	☒	☒

PROGRAM DEBUGGER

Interactive	☒	☒	☐	☒	☒
Command line	☒	☒	☐	☒	☒
Breakpoints	☒	☒	☐	☒	☒
Watchpoints	☒	☒	☐	☐	☒
Single-step execution	☒	☒	☐	☒	☒
Trace display	☒	☒	☐	☐	☒

LANGUAGE EXTENSIONS

Built-in commands and functions	350	500 [*]	390	400	574
Language support through API for:					
Assembler	☒	☒	☒	☒	☒
C	☒	☐	☒	☐	☒

DISTRIBUTION

Runtime module	☐	☒	☒	☒	☒
Price	N/A	\$250	Included	\$300	\$500
Maximum number of runtime module users	N/A	Unlimited	Unlimited	Unlimited	Unlimited
Runtime module with:					
Combined objects	N/A	☒	☒	☐	☒
Separate objects	N/A	☒	☒	☒	☒
Uses compact .EXE and runtime library	N/A	☐	☐	☐	☒
Uses single .EXE	N/A	☐	☐	☐	☒

N/A—Not applicable: The product does not have this feature.

^{*} dBASE III Plus has 233 built-in commands and functions; dBASE IV 1.1 has 435.

ENDS

dBASE IV

dBASE IV, Version 1.5, offers a number of improvements and enhancements over earlier releases. While the new features are welcome, the \$795 Version 1.5 doesn't represent a major modernization of *dBASE* in any way. The big splash, Borland International's *dBASE for Windows*, is yet to come.

The development environment begins with either the Control Center or the dot prompt, which is the traditional *dBASE* command interface. The Control Center is a menu system with several filename panels where you can neatly organize your databases, queries, forms, reports, labels, applications, and programs into a *catalog* and group together all of the files related to an application. The catalog facility shouldn't be confused with a traditional MAKE program or project manager, however. It simply helps you organize files for use within the Control Center.

The architecture of the Control Center has been opened up; there are now a number of places where you can plug in your own programs. For example, you can substitute your favorite report writer or screen designer for the ones built into *dBASE*, and you can specify programs to be run on entry and exit from several Control Center menus and options.

A number of tools are included. The program editor, invoked through MOD-

IFY COMMAND, lets you edit one program at a time within *dBASE*, or you can specify your own favorite editor to use in its place. The editor is useful, but for serious work you will likely want to use your own editor.

A forms designer can be used to design data entry forms. When you save a form, the designer generates code, which you can cut and paste into your own programs. You can also use the generated code with the SET FORMAT TO command for interactive operation with commands like EDIT.

THE APPLICATIONS GENERATOR

The Applications Generator can be used to design and generate complete applications. To do so, you work within a design surface that is similar to the other tools, and you create menus and other applications objects to be combined into the completed application. You'll need to spend some time with the manual, since the steps you need to go through to complete an application this way are not obvious or intuitive. Since *dBASE* has no dedicated menu designer, you can use the Applications Generator to prototype menus and then pull the generated menu code out of the generated application and paste it into your own code.

The development tools are not as intuitive and easy to use as those in *FoxPro*, but the program's new mouse support helps. With Version 1.5, the mouse is supported in all Control Center operations, the forms designer, the report designer, the applications generator, and so on. You can use the mouse in a BROWSE to move the cursor, or you can double-click on a memo field to bring up the memo editor. You can also use the mouse to move to an @...GET field in a READ. Missing are functions to return the cursor position or active window when a mouse button is clicked.

You can create and prototype queries

using a fill-in-the-blanks style query by example (QBE). The QBE work surface supports the mouse and lets you specify joins, conditions, and calculated fields, as well as the fields to include in the query results. Like the forms designer, QBE generates *dBASE* code to do the real work. The downside to this approach is that it performs more slowly than a tightly integrated query method with a query optimizer.

You can use the SET VIEW TO command in your program code to execute a query (the results are known as a *view*). This can be handy for gathering data from multiple tables just prior to printing a report. *dBASE IV*'s code-generating report designer can be used to produce attractive reports.

LANGUAGE IMPROVEMENTS

Several language extensions make their appearance in Version 1.5. A *smart key filter* implemented using the new SET KEY TO command lets you filter data based on an index expression. It is much faster than previous methods because it uses an existing index to find the matching records. This enhancement may be a response, at least in part, to Fox Software's Rushmore data access technique, which also uses indexes but does so globally and without requiring a new command. *dBASE IV* now includes a suite of low-level file I/O functions and provides support for passing a variable number of parameters to functions. Both additions match features found in competing products.

A new CONFIG.DB setting, SYSPROC=, lets you specify a high-level library of procedures that takes precedence over everything except internal *dBASE* commands. *dBASE IV* will search the SYSPROC library first when it doesn't recognize a command or function as being built-in. A new command, SET LIBRARY TO, lets you specify a procedure library that is searched last—only after all other attempts to find a match are exhausted. It's meant for generalized procedures that are used across many applications.

Conditional compilation directives are also available in Version 1.5. While this is not the complete preprocessor implementation found in *Clipper*, the directives will come in handy when writing cross-

SUITABILITY TO TASK				
dBASE IV				
Designing and prototyping	●	●	●	○
Report generation	●	●	●	○
Extending and interfacing	●	○	○	○
Development and distribution	●	●	○	○



dBASE IV's fill-in-the-blanks style QBE facility makes issuing multitable queries easier. You can also use the resulting code in your applications.

**The Creators
Of AutoCAD Have
Just One Thing
To Say To
All Those Who
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We have to admit, you're persistent. Year after year, you've had the same objections to learning CAD. So we've finally decided to do something about them.

Objection #1:

"IT TAKES TOO LONG TO LEARN."

Not any more. Now AutoCAD® runs on Windows.™

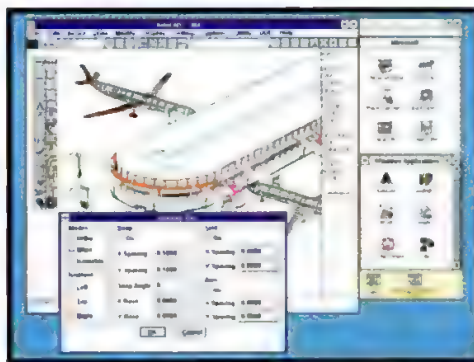
That means you get all the advantages of AutoCAD without memorizing command names. Instead, you create your drawings by selecting simple Windows tools and icons. So your learning curve is much shorter.

Objection #2:

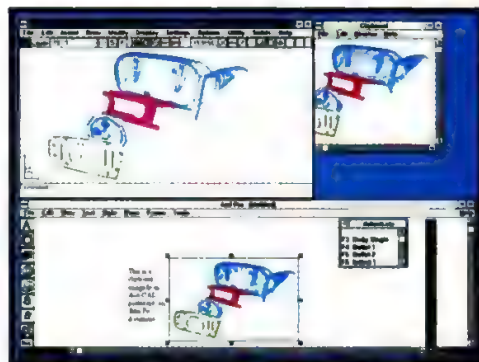
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Windows helps change all that. Its intuitive interface and pull-down menus eliminate most of the repetitive key-boarding that makes computer work feel confining.

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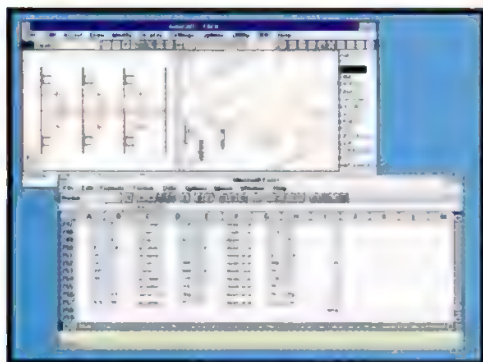
AutoCAD. Write the specs on your word-processor. Then use the Windows Clipboard to insert both pieces into a desktop publishing program, so you can polish your proposal.

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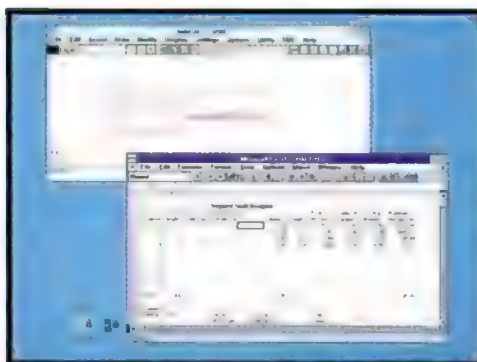
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 **AUTODESK**

platform code. Versions of *dBASE IV 1.5* are planned for 386 Unix, Sun SPARC systems, VAX/VMS, RS6000, and Macintosh environments. Applications that run on the DOS version should be portable to all of these environments.

In order to extend *dBASE IV* using assembly language you have to conform to *dBASE*'s aging *LOAD* and *CALL.BIN* interface. While this can be used to add custom routines, the interface is cumbersome, unpolished, and a far cry from the APIs found in *Clipper* or in *FoxPro*'s *Library Construction Kit*. *dBASE IV* sorely needs a better architecture for third-party add-ons.

DEBUGGING

dBASE IV's debugger includes support for up to ten breakpoints. You can watch expressions in a display window and can single-step through your code. Unfortunately the debugger's user interface is awkward. For example, to set a breakpoint on a line in your code, you have to know the line number and enter a breakpoint expression like "PROGRAM()="CUST".AND. LINENO()=20." You'll find the debugger unwieldy compared with the debugging support in *Clipper* or *FoxPro*.

For multiuser development, *dBASE IV* supports traditional file and record locking, both implicit and explicit. Also included are transaction-processing commands that let you define the boundaries of a transaction and issue a *ROLLBACK*

before the transaction is completed. To create an application for distribution you must purchase the \$250 *dBASE IV* runtime package, which comes with a utility that binds all of your *dBASE* object files into a single .DBO for execution with the runtime modules.

The new release did well on PC Magazine Labs' benchmark tests, especially when compared with the old release.

dBASE COMPATIBILITY: Friend or Foe?

by Sal Ricciardi

All of the products in this review are highly compatible with the *dBASE III Plus* language and the .DBF file format. But only Fox Software's *FoxPro*, Version 2.0, attempts to attain a high level of compatibility with *dBASE III Plus*'s successor, *dBASE IV*. Is this a problem?

Five years ago *dBASE*-compatible products labored in the shadow of Ashton-Tate's success in a young industry wholly dependent on *dBASE III Plus*. Because *dBASE III Plus* was so dominant, complete compatibility with Ashton-Tate's latest product became a must-have feature for the vendors of *dBASE*-like products. Since then, times have changed.

Today, products like *FoxPro* and *Clipper* have surpassed *dBASE* in technical innovation, and since no one product has emerged to replace *dBASE III Plus* as the language standard, strict and complete compatibility with the latest version of *dBASE* has become less important. *dBASE IV* simply doesn't dominate the market the way *dBASE III Plus* did. And so each of the Xbase vendors has extended the *dBASE III Plus* language in different ways.

For example, consider windowing. In *dBMAN V* you open a window by calling the *WINDOW* function. With both *dBASE IV* and *FoxPro*, you use the *DEFINE WINDOW* and *ACTIVATE WINDOW* commands. But there are differences in the number and types of options and parameters; *dBFast for Windows* uses the *CREATE WINDOW* command, and *Clipper* has no built-in windowing commands, so you have to use a third-party

dBASE IV 1.5 finished second on the *Load* and *Index* tests, mostly due to dramatically improved ASCII import performance. But it finished behind *Clipper* and *FoxPro* on transaction throughput.

Everything considered, *dBASE IV*, Version 1.5, is both faster and better than Version 1.1, but both *FoxPro* and *Clipper* make better sense for most serious Xbase development projects, unless you can take advantage of *dBASE IV*'s cross-platform support.

library or write your own.

The differences are likely to become more pronounced as vendors introduce object-oriented extensions into their languages and add event-driven programming techniques. Already, recently added support for interface controls like radio buttons and push buttons has added further incompatibilities among dialects.

Some analysts and developers argue that a multivendor language standard is needed—one that would specify the syntax and usage for extensions that go beyond *dBASE III Plus* while still leaving room for vendors to innovate and differentiate. This would bring an even greater level of cross-vendor compatibility to the Xbase industry and would make porting code between dialects easier. Opponents argue that a standards process would slow down innovation and that design by committee would undoubtedly encourage mediocrity.

In the absence of a committee-set standard, it seems unlikely that vendors will adopt a specific language implementation to replace *dBASE III Plus* as the core language. Only a major and clearly dominant influence could command that kind of compliance. Given the direction the vendors are taking, it may already be too late for a standard to form. A more likely scenario is that the vendors will continue to pick and choose from each other's inventions, and the core language that exists today will evolve all on its own.

In the meantime, one fact remains clear: All of the products reviewed here leverage your Xbase expertise in a big way. Perhaps that's standard enough. ■



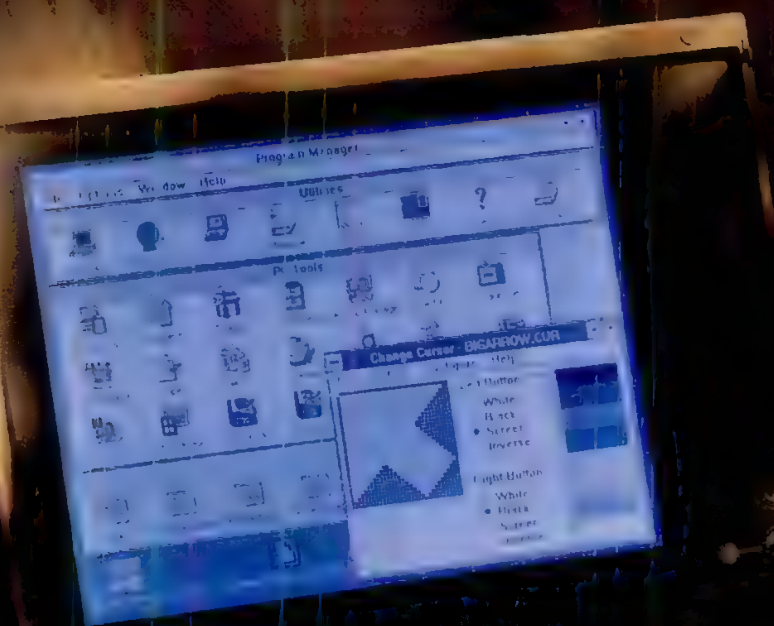
dBASE IV, Version 1.5

Borland International Inc., P.O. Box 660001, 1800 Green Hills Rd., Scotts Valley, CA 95067-0001; 800-331-0877, 408-438-8400. List Price: \$795; upgrade from any other version of *dBASE*, \$99.95; LAN Pack (1-count), \$395; LAN Pack (10-count), \$3,495; DOS runtime version, \$250.

Requires: 450K RAM, DOS 2.1 or later.

In Short: *dBASE IV*, Version 1.5, has a number of improvements over Version 1.1. While it is not the long-awaited modernization of *dBASE*, there is now strong cross-platform support.

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PERFORMANCE TESTS

Performance varied widely among our five Xbase products, but the longtime industry favorites like *FoxPro* still generally come out ahead of the pack.

HOW WE TESTED

To test the relative performance of the Xbase development systems reviewed here, PC Magazine Labs designed a comprehensive suite of tests adapted from the ANSI SQL Standard Scalable and Portable (AS³AP) database benchmark test, which is an industry-standard test suite developed at Cornell University.

The participating vendors were given specifications for each test and were asked to submit optimized code in their respective *dBASE*-style languages. The vendors were permitted to use any algorithms they wished in order to achieve the test objectives, but they were only allowed to use the functionality available within their products.

To simulate a realistic distribution scenario, all of the tests were run either in compiled form (.EXE) or with the products' multiuser runtime modules. The tests were conducted on a LAN running *NetWare 386*, Version 3.11, with a 16-megabit-per-second token ring in a file server configuration. Eight Compaq 386Ns with 5MB of memory functioned as workstations, connected to a Compaq SystemPro with 1.6GB of disk storage and 12MB of memory.

To provide a performance comparison with existing *dBASE* products, we ran the complete suite of tests under *dBASE III Plus*, Version 1.1, and *dBASE IV*, Version 1.1.

Because Versasoft Corp. was unable to provide PC Labs with truly optimized code within the testing period and because the test results were not indicative of the product's performance, we are not presenting *dBMAN V for MS-DOS*'s results.

LOAD AND INDEX

FoxPro is the best product for loading and indexing databases. It turned in times for both the 10,000- and 100,000-record table tests approximately twice as fast as the next best performer, *dBASE IV*, Version 1.5. Fox Software was the only vendor that utilized compound indexes for our tests, which may account for its product's superior speed. Compound indexes are Fox's version of the *dBASE IV* production index, which contains the various tags for indexed fields within the same index file.

dBASE IV 1.5 demonstrated an obvious improvement over Version 1.1 on the standard APPEND FROM DELIMITED command, which is used for importing ASCII data. The component modules within the Load and Index test, which use this command, showed up to a 90 percent timing reduction in Version 1.5, substantially improving the test's aggregate result.

The indexing operations also showed an 8 percent average time improvement on our tests.

dBFast for Windows, Version 1.7, turned in below-average times on the loading and indexing tests, taking well over 5 hours to complete the 100,000-record test. Like *dBASE IV* 1.1, *dBFast* suffers most significantly on the execution of the APPEND FROM DELIMITED command. However, *dBFast*'s indexing results were below average as well.

The **Load and Index** test measures how quickly a database package can import and index a two-table database. The test is run on two data sets, one containing 10,000 records per table and the other containing 100,000 records per table. The data is imported from two comma-delimited ASCII files, and nine distinct indexes are created on the database.

OUTPUT

FoxPro and *dBASE IV* 1.5 turned in the best performance on our Output overhead tests. *dBFast* produced extremely slow scores while outputting both to the file and to the screen. *dBFast* is a Microsoft Windows product, which might contribute to its slow speed, but we believe there is more to the explanation. As part of our testing, we required each package to output the contents of all fields in 100 selected records to a print file. All of the packages tested were able to do this through a version of the LIST command—except for *dBFast*. To achieve this with *dBFast*, the "?" command was used to output to the printer device, and the output was redirected to the test output file. This technique—not the operation within the Windows environment—was probably the key factor in the 32-second output to file score.

Clipper, Version 5.01, which requires explicit specification of each field with the LIST command, produced a relatively slow score for outputting to a file as well. *Clipper*'s version of the LIST command does not default to outputting all fields within the specified record scope.

FoxPro and all of the *dBASE* versions that we tested turned in the same score of 3 seconds for outputting to a file. *dBFast* produced the slowest time for outputting to

the screen—a result clearly due to its graphical Windows environment. In order to scroll the selected records to the screen, the *dBFast* code used explicit @SAY..GETs for each field within the 100 selected records of the test. This additional formatting added overhead to the test. All of the other products were able to output the records to screen with a version of the LIST OFF command. Again, the *Clipper* code specified each field to be listed to the screen. *dBASE IV* turned in the fastest time on this test, outputting the 100 records to the screen in 2 seconds flat.

Clipper clearly outperformed the competition outputting to another database table, completing the operation within 1 second. *dBFast* performed well on this test; it trailed *Clipper* by only 1 second.

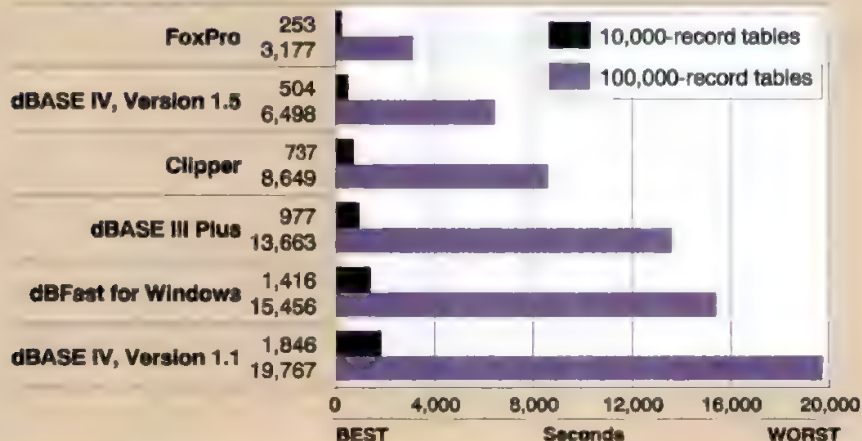
The **Output** test measures the time taken to output sequential records from the 10,000-record table to a file, to the screen, and to another database table. PC Labs ran the Output test on data sets consisting of 0, 10, 100, and 1,000 records, and it was determined that the 100-record data set produced the most accurate results, minimizing any overhead unassociated with the output function being performed. The Output test was performed three times for each product, and the average is presented in the accompanying charts.

LOAD AND INDEX

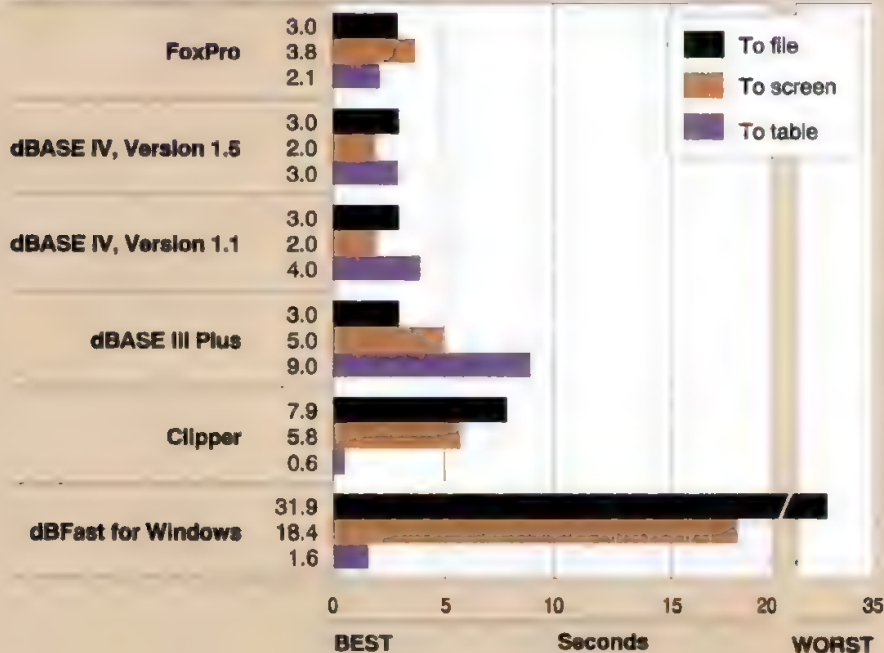
Lower scores represent better performance.

	10,000-record tables (hours:minutes:seconds)	100,000-record tables (hours:minutes:seconds)
FoxPro	00:04:13	00:52:57
dBASE IV, Version 1.5	00:08:24	01:48:18
Clipper	00:12:17	02:24:09
dBASE III Plus	00:16:17	03:47:43
dBFast for Windows	00:23:36	04:17:36
dBASE IV, Version 1.1	00:30:46	05:29:27

LOAD AND INDEX



OUTPUT



CONTINUES

dBFast for Windows

As of this writing, *dBFast for Windows*, Computer Associates International's \$550 Version 1.7C is the only Xbase development product designed to produce Microsoft Windows applications. But while it provides *dBASE III Plus* language and file compatibility, it doesn't provide the kind of full-featured easy-to-use development environment you might expect from a Windows product. Instead, *dBFast* offers a very basic development environment, along with language extensions that let you use Windows-style features and event-driven programming techniques in your applications.

The *dBFast* development environment consists of a pull-down menu system that substitutes for the traditional command line edit/compile/link cycle. A built-in editor lets you create and modify programs in up to four windows. You can compile and run programs or create runtime-linked applications directly from menu choices. Several basic utilities are included. For example, a Data File utility written in the *dBFast* language can be used to define a database structure and create databases. This is somewhat like the DBU utility included with *Clipper*, but far less capable. Also included are rudimentary label and report generators.

A command window lets you enter and execute a limited subset of *dBFast* commands. You can select work areas, use databases, and set relations, but many

**dBFast for Windows, Version 1.7C**

Computer Associates International Inc., One Computer Associates Plaza, Islandia, NY 11788; 800-225-5224, 516-342-6000

List Price: \$550.

Requires: 1MB RAM, Microsoft Windows 3.0 or later, DOS 3.0 or later.

In Short: *dBFast for Windows*, Version 1.7, is an Xbase development system for Microsoft Windows. Despite the interesting possibilities it provides, the current version is somewhat unstable. *dBFast* could not complete some of our performance tests.

CIRCLE 459 ON READER SERVICE CARD

commands aren't available. Issuing a SET PROCEDURE TO command from the command window caused an "Unrecoverable Application Error" message, so you cannot test User Defined Functions (UDFs) from here. The window also has no history, so you won't be able to recall previously issued commands.

WINDOWS EXTENSIONS

dBFast has a number of language extensions. For example, to create a window you use the SET WINDOW TYPE command to assign the window characteristics and then issue the CREATE WINDOW command. You can use check boxes, edit boxes, list boxes, or radio buttons in your programs using extensions to @...GET. A typical Windows-style pull-down menu system can be created using CREATE PULLDOWN MENU, CREATE POPUP MENU, and SET MENU TO. In case you'd rather substitute push

SUITABILITY TO TASK				
<i>dBFast</i> for Windows				
Designing and prototyping	●	○	○	○
Report generation	●	●	○	○
Extending and interfacing	●	●	○	○
Development and distribution	●	●	○	○

buttons for menu options, there's CREATE BUTTON. You can even use a bitmap as a push button by means of the CREATE PICTURE BUTTON function.

While these extensions are useful, to make them work you need to incorporate event-driven programming constructions into your programs. To do this, you create an event loop within your program and use *dBFast*'s CHKEVENT() and EVENT() functions to determine and respond to events. For example, EVENT() returns a 2 when a menu event occurs. You can then use HMENU() and VMENU() to determine which menu option was selected.

Support for the Windows DDE protocol is also included. You can make your application a DDE client or server and can establish DDE conversations with other Windows applications such as *Microsoft Excel*. A special form of the DECLARE command lets you call Windows DLLs.

LIMITED DEBUGGING

dBFast's debugger is badly misnamed. The debug window is actually a twist between DISPLAY STATUS and DISPLAY MEMORY. It pops up at runtime if you

set debug on, but it only allows you to view a list of memory variables and the status of open files and work areas. From here you can either resume execution or choose to quit. You cannot single-step through your code (SET STEP ON is accepted by the compiler but does nothing), set breakpoints, or watch variables. The SUSPEND command—which is completely undocumented—will suspend operation and bring up the debug window.

To create an application for distribution, you choose Link from the File menu

and select your main program module. *dBFast* then compiles your program and all subsidiary programs into a single tokenized .FST file. It also creates a renamed version of the *dBFast* runtime executable. For example, if your application is CUST.PRG, you will get a CUST.FST and a CUST.EXE. Both will have to be distributed. The unlimited-distribution runtime module is included with the basic product at no extra charge.

The current release supports the creation of multiuser applications using traditional record and file locking. The documentation provided with *dBFast* is

PERFORMANCE TESTS

MIXED WORKLOAD

The Mixed Workload test results reveal the degree to which the system allows data sharing and the impact the sharing has on response time. Look at the results in two ways: how much total work was done (shown in the Throughput chart) and how long a single station took to complete

its work (the Elapsed Time chart).

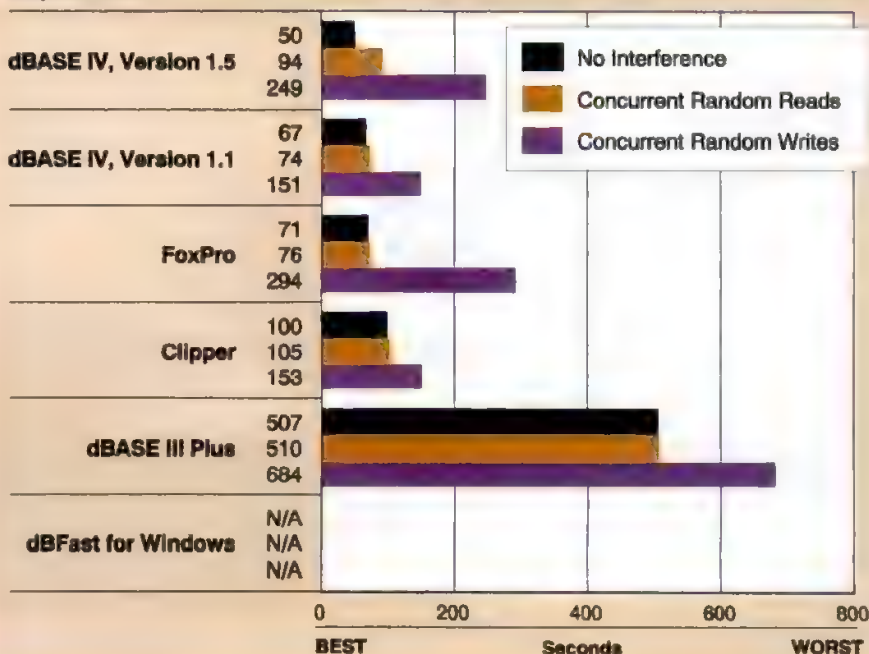
Since the Throughput chart shows the amount of work accomplished, and since that number is affected by the number of users generating work, it indirectly tells you about the system's concurrency control. Look at the results of the Concurrent Random Reads test to determine how much throughput you can

MIXED WORKLOAD

Elapsed Time Lower scores represent better performance.	No Interference (minutes:seconds)	Concurrent Random Reads (minutes:seconds)	Concurrent Random Writes (minutes:seconds)
dBASE IV, Version 1.5	00:50	01:34	04:09
dBASE IV, Version 1.1	01:07	01:14	02:31
FoxPro	01:11	01:16	04:54
Clipper	01:40	01:45	02:33
dBASE III Plus	08:27	08:30	11:24
dBFast for Windows	N/A	N/A	N/A

MIXED WORKLOAD

Elapsed Time



lacking. For example, the reference manual does not document the supported PICTURE and FUNCTION codes. In addition, the product needs a well-written tutorial and better, more useful demonstration programs. The user manual leads you through the sample program FIRST.PRG, but it doesn't work as documented.

In addition, *dBFast* suffers from some stability problems. On several occasions during testing, we found ourselves thrown out of Windows and staring at the DOS prompt for no apparent reason. Also, *dBFast* could not complete our

Mixed Workload tests, locking up the test machine.

The performance results we were able to obtain were not exceptional. While *dBFast* was able to complete the Load and Index tests, it finished behind the leaders.

dBFast for Windows shows promise, but in general feels rushed and is therefore hard to recommend. To be fair, Computer Associates International acquired *dBFast for Windows* from its previous owner only a short time before this review, so the product is still immature and does not re-

dBFast for Windows
shows promise,
but in general feels rushed;
the company acquired it
only a short time
before our review.

expect from a database system when a variety of users are reading from but not writing to the database.

The results of the Concurrent Random Writes test show the sophistication of the systems' locking schemes, since the operations require the highest level of isolation from one another. Since neither the Concurrent Random Reads nor the Concurrent Random Writes test institutes *think time* within each iteration, the effect of seven workstations executing the tests simultaneously is much more strenuous than a real-world scenario with the same number of workstations.

Both *dBASE IV* and *FoxPro* experienced noticeable difficulty managing the simultaneous requests for file and record locks produced by the Mixed Workload test

with Concurrent Random Writes. Both packages were tested with their implicit locking schemes enabled. Because of the rapid succession of record-locking requests from the seven workstations producing the write interference, the *dBASE* workstation executing the Mixed Workload test had to wait for up to 1 minute to acquire file locks to perform certain operations. *FoxPro* was unable to obtain the file locks at all, so we modified the source code to force the file lock to occur based on the presence of a temporary semaphore file. The fact that this situation can occur suggests that the current crop of Xbase development systems needs more intelligent concurrency control.

The extremely slow *dBASE III Plus* results are due to its lack of a CALCULATE

command. The CALCULATE command can prove very effective during one of the component tests that simulates a joined report.

dBFast was unable to execute the Mixed Workload tests successfully; Windows' Unrecoverable Application Error message occurred during a scoped index operation. Computer Associates International was not able to provide a solution.

The **Mixed Workload** tests show the effect of data sharing on response time and throughput. There are three Mixed Workload tests in the suite: With No Interference, With Concurrent Random Reads, and With Concurrent Random Writes. The results are reported in terms of both elapsed time and throughput rates in separate graphs.

In the **No Interference** test, a single workstation runs a mixed workload of eight database operations, including queries, updates, and an aggregate report joining two tables. We record the total time to run all eight operations, and compute the average number of transactions per second.

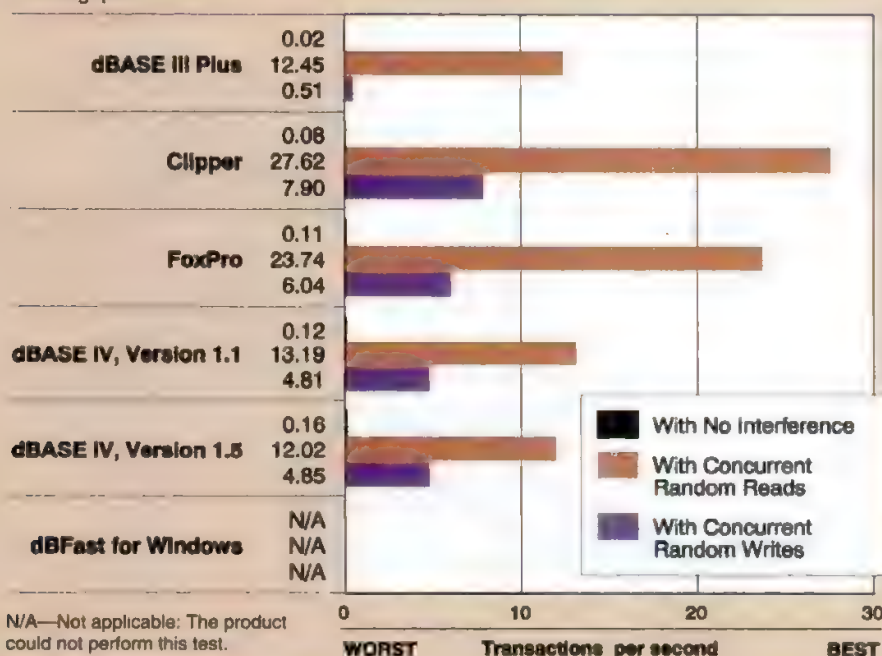
In the **Concurrent Random Reads** test, we run Random Read queries on seven workstations. (For a complete description of our Random Read test, see the issue of March 31, 1992, page 324.) We then add an eighth station running the same Mixed Workload routines as in the No Interference test. When the eighth station finishes, we stop all stations and record the total time that the eighth workstation took to complete its routines. To compute throughput, we divide the total number of transactions that all eight stations performed by the total test time.

The **Concurrent Random Writes** test is the same as the Concurrent Random Reads test, but instead of running the Random Read queries, we run the Random Write transactions.

The Random Read and Random Write stations access just one of the two tables in the test database; the Mixed Workload station accesses both.

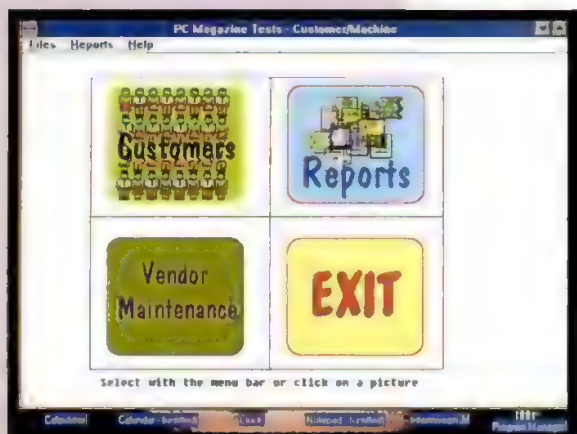
MIXED WORKLOAD

Throughput



N/A—Not applicable: The product could not perform this test.

ENDS



dBaseFast for Windows' language extensions provide access to many of Microsoft Windows' user interface elements and let you use bitmaps for push buttons, as shown here.

flect the influence its new owner will undoubtedly bring to bear. In the meantime, if you absolutely must have a Windows Xbase product immediately, it's your only choice.

dBMAN V for MS-DOS

Versasoft Corp.'s \$350 *dBMAN V for MS-DOS*, Version 5.31, has a history that dates back to the early 1980s. Once a contender for the title of fastest *dBASE III* work-alike, it now caters mostly to customers requiring extensive cross-platform support. The product is available on many platforms, including many forms of Unix/Xenix and some unusual ones like the Atari ST and the Commodore Amiga. Unfortunately, the DOS version of the product is showing its age.

The development environment can be described as basic *dBASE III Plus*. A command prompt displayed at the top of the screen substitutes for the *dBASE* dot prompt and lets you enter commands directly, while the *ASSIST* command lets you choose operations from a pull-down menu system. The development tools provided include an editor, an applications generator, a screen generator, and a report writer. All of the tools except for the report writer are very rudimentary. The report writer, though cumbersome

and not at all intuitive compared with some of the others reviewed here, does have some interesting capabilities. For example, you can use it to create multitable one-to-many reports with built-in relations—something neither *Clipper* nor *dBaseFast for Windows*' simplistic report writers can handle.

You can single-step through your code using *dBMAN V*'s debugging aids. If you haven't SET ESCAPE OFF, you can press Ctrl-T repeatedly to trace a line at a time, and you can also set a single program breakpoint using the SET BREAK TO command, which requires the line number where you wish to suspend execution.

Unfortunately, on PC Magazine Labs' tests, *dBMAN V* seemed to get confused easily during debugging, often refusing to resume after a program was suspended. More than once, entering the QUIT command at this point locked up the machine entirely.

The *dBMAN V* language includes a number of enhancements over standard Xbase. One useful language extension is the alias modifier. This can be used on all scoped commands to force the scope to be derived from a work area other than the current work area. For example, if you are positioned in the CUST work area and you want to replace all balances in the BAL work area with 0, you can do so like this: REPLACE %BAL ALL BAL->BALANCE WITH 0. The %BAL modifier does the equivalent of a SELECT BAL and then returns to the current work area after the operation.

This can be handy indeed and can help clarify your code, since it explicitly identifies the work area used for the scope. (See "Databases," *PC Magazine*, February 25, 1992, for a general explanation of the confusing aspects of command scope.)

A SHOP command can be used to pop up a picklist of records from a database.

SUITABILITY TO TASK

dBMAN V for MS-DOS

Designing and prototyping	☐	☐	☐	☐
Report generation	☒	☒	☒	☐
Extending and interfacing	☒	☐	☐	☐
Development and distribution	☒	☒	☐	☐

The user can then scroll the list and press Enter to make a choice, an operation similar to using the BROWSE command with an ON KEY LABEL assigned to the Enter key in other Xbase dialects. Another useful addition is that you can have multiple procedure files open at the same time. *dBMAN V* simply adds each procedure file to the list of files to search for called functions.

Prior to starting up *dBMAN V*, you need to set an environment variable telling it where to find its overlay files. If you forget to do this, strange and mysterious things happen: In general, either your program doesn't work as expected or it crashes. Versasoft could save developers a lot of time by putting up a warning message at start-up if the environment variable isn't set correctly.

To create a distributable version of your application, you can purchase the *dBMAN V* runtime package for \$300. First you compile your code using the GLGEN utility, which creates a tokenized version of your program. Then you execute your program using the runtime module GLEXE. A \$695 multiuser version of *dBMAN V* is available for creating multiuser applications that support file and record locking. You'll need the \$500



dBMAN V's *ASSIST* command launches a pull-down menu system that you can use instead of the CMD prompt to execute commands.

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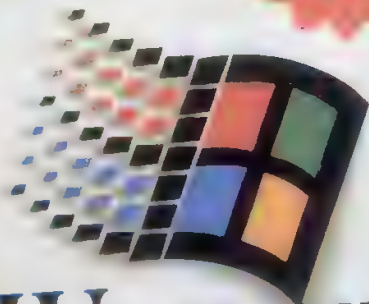
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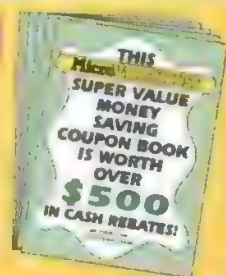
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Multisoft Corporation		
UT0554	PC Kwik Power Pak 2.1	75
UT0543/5	Super PC - Kwik 4.1	45
Norton-Lambert		
CM0503/5	*Close-Up 4.0 / Windows & DOS	119
Okna Corporation		
BS3124	*The DeskTop Set 3.0	79
PC Globe, Inc.		
BS1834	PC Globe 5.0	37
BS1844	PC JSA 2.0	29
Peachtree Software		
FN0233/5	Peachtree Complete III 5.0	145
Polaris		
BS2804	*PackRat 4.0	259
Power Up Software		
BS1654	Calendar Creator Plus 4.0	55
Qualitas		
UT0684	386MAX 6.0	61
Quarterdeck Office System		
BS1043/5	DESView 386 2.4	129
EX103/5	QEMM 386 6.0	61
Reference Software		
WP0514	*Grammatik Windows	55
Software Directions		
UT1914	Print Q 5.0	85
Spinmaker Software		
BS1923/5	BetterWorking Eight-In-One	32
BS3604	*PFS Window Works	125
Symantec		
UT2273/5	Norton AntiVirus 2.0	85
UT2183/5	*Norton Desktop for Windows	99
UT2131/5	Norton Util. Advanced 6.01	115
UT2153	Norton Backup Windows/DOS	85
CM0173/5	PC Anywhere 4.5 Host and Remote	119
BS4013/5	Q&A 4.0	255
BS3723/5	*On Target 1.0	255
Technology Interchange Group		
BS5915	The Hard Disk Survival Kit	169
BS5905	Your PC Inside-Out	169
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FN0414	*M Y O B for Windows	135
Timeslips		
BS5953/5	*TimeSheet Professional for Windows	145
BS0133/5	Timeslips III 4.0	189
Tool Technology Publishing		
UT2253	*WinTools	125
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UT2074	LapLink Pro 4.0	109
Triton		
CM0543/5	CO/Session	99
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WP0363/5	WordPerfect 5.1	279
WP1653/5	*WordPerfect 5.1 for Windows	295
WordStar U.S.A.		
WP1604	*Correct Grammar for Windows	65
XTree Company		
UT1874	XTree Gold 2.5	99

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Borland International		
LN1654	Borland C++ 3.0 Prof	329
LN0484	*C++ for Windows	319
LN1664	*Object Vision 2.0 for Windows	109
LN0464	Turbo C++ 2nd Edition 1.0	69
LN0463/5	*Turbo C++ for Windows	109
Microsoft		
LN0085	QuickBasic 4.5	65
LN1674	Visual Basic	169

LANGUAGES

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LN1664	★Object Vision 2.0 for Windows	105
LN0464	Turbo C++ 2nd Edition 1.0	69
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The Hard Disk Survival Kit™

The Hard Disk Survival Kit, for NonTechnical Users demonstrates and explains all the techniques and skills necessary for resurrecting your hard disk and reconstructing files and data. This comprehensive package covers all aspects of your PC's internal workings. Includes a two-hour video, detailed workbook, utility disk and tool kit.

Publisher: Technology Interchange Group BS5915

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★Adobe Illustrator 4.0

Adobe Illustrator 4.0 for Windows provides a professional illustration solution for the PC environment. This new version of the program allows graphic artists, designers and desktop publishers to create professional-quality illustration and design. This value packed program includes Adobe Type Manager software (ATM), 40 Adobe Type 1 type faces, the Adobe TypeAlign type manipulation program, Adobe Separator color separation software and a generous selection of Adobe patterns, textures symbols, and borders. Other features include: Edit in preview, On-screen text, Resizable toolbox plus enter and edit text directly on screen. With Adobe Illustrator, users can now freely exchange files between Windows, Macintosh and NeXT desktop platforms. Publisher: Adobe Systems GR5144

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FAX PAK brings together WinFax PRO and FAXGrabber - giving you easy, automatic integration of faxes from your PC fax board into virtually any application. And, FAX PAK includes Norton Desktop for Windows making fax and desktop file management even easier. With Delrina's WinFax PRO, PC Magazine's "Best of 1991", you can send high quality faxes from any Windows 3 application and receive faxes in the background, from any Group 3 fax device. Then FAXGrabber completes the fax solution by taking those incoming faxes and automatically converts them into your favorite word processing, spreadsheet or desktop publishing application for instant revision or routing via E-mail. WinFax PRO and FAXGrabber reside as icons in your Norton desktop environment, for easy access.

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**Targus Universal
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Designed especially for the new generation of Notebook PCs, the Targus Universal Notebook Carrying Case provides a convenient way to tote your computer and accessories (including a printer). Two padded compartments (11x13 x 2.5 inches each) keep your Notebook computer and accessories separated. Non-skid rubber feet, rugged Coskin finish, velcro closures and self-healing nylon zippers top it off. Publisher: Targus Also available: Luggage 5 Midsize Case AC3360 \$48. Premier Black Leather Carry Case AC2340 \$169.

Targus Universal Notebook
Carrying Case
AC0670

\$66



dbMAN V for MS-DOS, Version 5.31
Versasoft Corp., 4340 Almaden Expwy., #110,
San Jose, CA 95118; 408-723-9044.
List Price: \$350; network version, \$695; DOS
runtime version, \$300; network runtime
version, \$500.
Requires: 440K RAM (480K RAM for LAN),
DOS 2.0 or later (DOS 3.1 or later for LAN).
In Short: *dbMAN V*, Version 5.31, is available
on many platforms and includes some
interesting language extensions, but it doesn't
fare well against its competition.

CIRCLE 488 ON READER SERVICE CARD

network runtime version to distribute multiuser applications.

Versasoft could not deliver optimized benchmark test code to meet our specifications in time for this review. In informal testing with the *dbMAN V* runtime compiler, we found *dbMAN V* to be slightly faster than *dBASE III Plus* on some operations, such as scoped commands like REPLACE and COPY TO, and much slower at indexing and sorting. When compared with *FoxPro*, *dbMAN V* lagged far behind.

dbMAN V's language extensions are useful, and its cross-platform support may be important for some applications. But in the final analysis, *dbMAN V* seems both behind the times and a bit quirky and is therefore hard to recommend.

FoxPro

Fox Software's \$795 *FoxPro*, Version 2.0, a *PC Magazine* Technical Excellence Award winner, combines a very productive development environment with solid performance and tools that can help you build professional applications quickly.

The development environment consists of a multiple-window pull-down menu desktop with mouse support and menu selections that correspond closely to *FoxPro* commands. You can issue commands through the menus and dialog boxes or enter them directly in the Command window—Fox's version of the *dBASE* DOT prompt. A View window provides a

home base from which you can perform administrative chores: open databases, define relations, modify database indexes, and so on. When you are creating a database, a mouse click to the left of the field name lets you create an index tag.

Although none of the tools are required, you'll want to buy into the *FoxPro* way of doing things to get the most out of it, and that means using the development tools. To begin a new application, you start with the Project Manager (PM). The PM is a gathering place for all of the elements of an application: screen designs, report designs, programs, menus, and so on. It works like a MAKE facility in that it keeps your applications current by recompiling only those elements that have changed. From there you can start any of the other tools needed to design an application. The *FoxPro* development philosophy encourages using the PM as the launching pad and then using the tools to design objects, write code snippets, and generate the code for your applications.

TOOL-ORIENTED DEVELOPMENT

Most experienced database developers are used to the code being the focus and the place where you edit or make changes. When you use *FoxPro*'s tools you cannot directly modify the generated source code and then go back to using the tools. If you do, the next time you generate code your modifications will be wiped out. Instead, you must make all of your changes using the tools; working within the tools must be your normal work environment. You can choose to bypass the development tools entirely, but you probably won't want to do that since they can greatly increase your productivity.

The Screen Builder lets you use the mouse to design data entry forms, dialog boxes, and windows that make use of *FoxPro*'s user interface elements: radio buttons, push buttons, text entry regions, check boxes, scrollable lists, invisible buttons, and pop-up menus. In addition, you can enter code snippets directly onto your screen designs so that they become part of the screen. To design pull-down

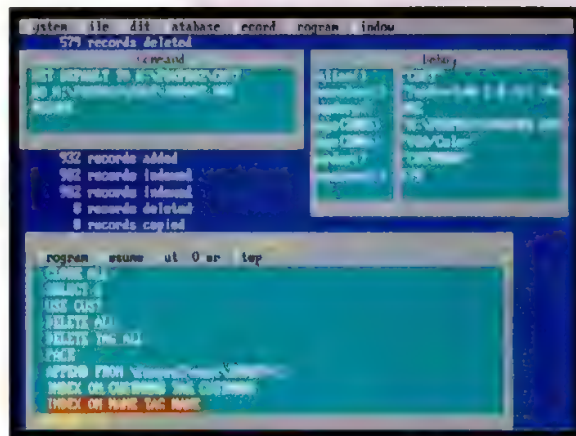
FoxPro combines a productive development environment with solid performance.

menus there's a dedicated Menu Builder that, like the Screen Builder, stores its information in a special database. Here, too, you can attach code to objects in the Menu Builder that will be included in your final application.

OPTIMIZING QUERIES

The task of coding queries is made easier in two ways. First, there's Fox's implementation of the SQL SELECT statement. SELECT is nonprocedural, which means it lets *FoxPro* decide the best way to get its results. *FoxPro*'s implementation includes an adaptive query optimizer, which takes advantage of optimization opportunities that aren't available with traditional *dBASE* code, since a single SELECT does what would normally require numerous *FoxPro* statements.

Another timesaver is relational query by example (RQBE), which lets you enter information through dialogs and menus and generate a SQL SELECT statement.



FoxPro's powerful development environment includes TRACE and DEBUG windows and a scrollable command window where you can enter and execute *FoxPro* commands.

RQBE is useful for prototyping queries as well as for learning SELECT, since you can stop at any point to see what the associated SELECT statement would look like. The output from SELECT can be sent to a .DBF file, an ASCII file, the printer, or a temporary cursor, which can then be used for a report or with BROWSE. On the downside, RQBE cannot be included in the programs you distribute.

FoxPro's Rushmore data-access technique takes advantage of available indexes to speed up data access dramatically for certain optimizable queries. In general, any command with a FOR clause containing an index expression is a candidate, though the official rules on what's optimizable and what's not are defined in the *FoxPro* documentation. You'll want to read them carefully, since our tests have shown Rushmore to have a very significant impact on performance.

FoxPro's compound index files (.CDX) can combine what would previously have been many individual index files into a single file, which is automatically opened with its associated database. While this is similar in concept to the .MDX files introduced in *dBASE IV*, *FoxPro* compresses .CDX files so that they take up much less space on disk. Since the index is physically smaller, *FoxPro* keeps more of it in RAM where it can be accessed faster and better utilized by Rushmore. Single-entry index files are also available for backward compatibility.

The report writer is object-oriented,

*FoxPro has been
criticized for sluggishness,
but it performed admirably
on our tests.*

banded, and very capable. You can easily design a variety of free-form and line-oriented reports and click and drag objects around on the report surface. A preview mode is provided so you can see exactly what your report will look like when printed. *FoxPro* doesn't offer a code-generation option for the report writer, but third-party products such as FRX2PRG can fill that gap (see "Databases," *PC Magazine*, September 10, 1991).

FoxPro's programming language is extensive and largely a superset of *dBASE IV's*. Some *dBASE IV* commands are not supported, such as BEGIN/END TRANSACTION and ROLLBACK. However, *FoxPro* has a SET COMPATIBLE TO DB4 command that makes it act more like *dBASE IV*. For the most part, porting a *dBASE III Plus* or *dBASE IV* application to *FoxPro* should be a smooth process.

You can build event-driven programs using additions to the READ mechanism built into *FoxPro*. The techniques used to accomplish this are not simple, but *FoxPro* includes several sample applications that demonstrate them. You can, for example, have several windows and several BROWSEs active at the same time, while being able to mouse-click between them. The BROWSE command can be customized to attach field-level validation to every column in the BROWSE.

Debugging features are also included. You can open a trace window to monitor program execution visually, step through your code a line at a time, set breakpoints, and so on. A debug window can be used to monitor variables and expressions, and you can set up a breakpoint to occur when an expression in the debug window changes value.

For multiuser development, the \$895 network version, *FoxPro/LAN*, supports concurrent use through traditional file and record locking, both implicit and explicit. You can explicitly lock records and files using the RLOCK() and FLOCK() func-

tions, or use implicit locking and an ON ERROR type handler to trap and respond to contention conditions.

To create applications for distribution you'll need *FoxPro's* \$500 *Distribution Kit*. This buys you an unlimited distribution license for your application. During installation, you give the *Distribution Kit* your *FoxPro* or *FoxPro/LAN* serial number and it installs on top of your existing interactive product in the same directory. Once it is installed, several options become enabled in the Project Manager. You can create a compact .EXE file that requires the *FoxPro* support library files to be available at runtime. You can also create two types of freestanding .EXEs. The first has the same requirements as the standard version of *FoxPro*. The second, an extended .EXE, has the same requirements as the extended version of *FoxPro*,

SUITABILITY TO TASK				
<i>FoxPro</i>				
Designing and prototyping	●	●	●	●
Report generation	●	●	●	●
Extending and interfacing	●	●	●	●
Development and distribution	●	●	●	●

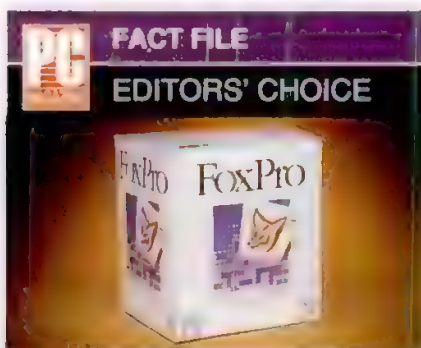
namely a 386 or 486 processor and at least 2MB of RAM. Be forewarned that *FoxPro's* .EXEs are huge—frequently over 1MB in size.

Fox Software offers a \$500 *Library Construction Kit* for extending *FoxPro* with custom routines. This lets you build external libraries in C or assembler that can be loaded and made available to *FoxPro* programs via the SET LIBRARY TO command. This should help Fox attract a third-party market for *FoxPro* add-ins, although it's hard to predict whether Fox will be as successful at this as Nantucket has been.

FoxPro has been criticized for performing sluggishly on low-end hardware, especially when you make frequent use of the new user interface gadgets and controls. On our tests, *FoxPro* performed admirably, finishing first or second on almost all of the tests.

In the final analysis, *FoxPro* is a highly productive development environment, and in a word, fun. If you're looking for an Xbase development system, *FoxPro* is an excellent choice. ■

Sal Ricciardi is the author of PC Magazine's Databases column and is also an independent consultant.



FoxPro, Version 2.0

Fox Software Inc., 134 W. South Boundary, Perrysburg, Ohio 43551; 419-874-0162.

List Price: \$795; *FoxPro/LAN*, Version 2.0 (six users), \$895; *Distribution Kit*, \$500; *Library Construction Kit*, \$500.

Requires: 512K RAM, DOS 2.0 or later (DOS 3.1 or later for LAN).

In Short: *FoxPro*, Version 2.0, is a solid performer with a wonderful user-friendly environment for developing Xbase applications.

CIRCLE 457 ON READER SERVICE CARD

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by
Joe Salemi

Advisor

EXPANDED FROM EXTENDED

I am interested in a program to convert extended memory into expanded memory on a 286 machine. I read in your magazine that such a utility is available, and I would be grateful if you could let me know what issue this program was in.

Charles D. Goldman, M.D.
Edina, Minnesota



The utility you're referring to is EMS40.SYS, written by contributing editor Douglas Boling, which appeared in the June 27, 1989, issue. Version 1.1 is available in Library 2 (PCMag Utils) of the Utilities/Tips Forum on PC MagNet.

Other drivers are available that provide more functionality. SoftBytes (Veri-comp, P.O. Box 55238, Grand Junction, CO 81505; 800-876-0400, 303-241-5800; \$49.95) provides simulated LIM 4.0 expanded memory either in extended memory or as virtual memory on a hard disk. The shareware program VRAM (Biologic Corp., 7950 Blue Gray Circle, #1622, Manassas, VA 22110; 703-368-2949; \$49) also simulates expanded memory in extended memory or on-disk.

Biologic offers other utilities that help manage memory on 8088 and 80286 systems. HRAM provides high DOS memory on systems with DOS 5.0 and expanded memory, and MIN-MEM lets you load TSRs into expanded or extended memory. Through the end of June 1992, Biologic is bundling all three utilities for \$45. The shareware versions of these utilities can be downloaded from library 3 of the IBMSYS Forum on CompuServe or from Library 6 (Advisor) of the Utilities/Tips Forum on PC MagNet. Simply download the file MEMKIT.ZIP and you'll be on your way.

JOYSTICK AS A MOUSE?

A friend of mine has a daughter with cerebral palsy who can handle herself well with the help of her electric wheelchair and a few more devices. Now she's

■ **EXPANDED FROM EXTENDED: Utilities that turn extended memory into expanded memory on 286 systems.**

■ **JOYSTICK AS A MOUSE? Are there any drivers available that let a joystick work like a mouse?**

■ **MORE ON DVORAK KEYBOARDS: A source for more information about this alternative keyboard layout.**

about to enter college, and we're trying to equip her with a computer that runs *Microsoft Works* and other software in the Microsoft Windows environment. The problem is that she has trouble manipulating a mouse; she can handle a joystick, but we don't have a driver for this device in the *Works* or Windows environment. Do you know either where we can get a joystick driver or how to make a joystick look like a mouse to the computer?

I'd appreciate any other information you can provide concerning the use of computers by the handicapped.

Gustavo Flores
Tlalpán, Mexico



Personal computing for people with disabilities has become a strong interest of mine, and I conducted an extensive search for a solution to your problem. It was difficult to find a driver or device that let a joystick work like a mouse on a PC, but a company that has made such a device for Macintosh computers for over three years has just released a PC version. The MouseStick (Advanced Gravis Computer Technol-

ogy, 1602 Carolina St., #D12, Bellingham, WA 98226; 800-663-8558, 604-434-7274; \$129.95), an optical joystick with eight levels of tension adjustment, has drivers that let it replace a mouse in most applications, including Windows 3.0. The MouseStick uses a bus-port board with a separate port for a standard analog joystick.

One source for more information on products for people with disabilities is The Access Technology Association (1747 Pennsylvania Ave. NW, #250, Washington, DC 20006; 202-785-5222), a nonprofit organization of access technology suppliers.

MORE ON DVORAK KEYBOARDS

I've received a number of letters asking for more information on Dvorak keyboards after mentioning sources for them in the August 1991 column. Rather than constantly replying to similar questions, I'd like to pass on some information sent to me by Waldo T. Boyd of Geyserville, California:

"I thought you might like to have the address of the president of the Dvorak Association, in case others inquire about this remarkable keyboard arrangement. You probably already know that 'pure Dvorak' included a different numerical arrangement than the layout that is commonly called Dvorak today. This change was made to accommodate the hardware bus connections paralleling the accountants' keypad and the line of numerals across the upper row above the letters.

"You can contact the president, Robert P. Holston, at 10 Garfield Pl., Massapequa, NY 11758."

ASK THE ADVISOR

Send your question to Advisor, One Park Avenue, New York, NY 10016; MCI mailbox PC MAGAZINE; or upload it to PC MagNet (see access instructions on page 10 of this issue). We regret that we are unable to acknowledge submissions or answer letters individually. ■

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by
Jeff Prosis

Tutor

SWAPPING LPT PORTS

I have a flatbed scanner connected to my computer's LPT1 and a dot matrix printer connected to LPT2. The adapter card for the scanner can only be configured as LPT1, which prevents me from switching the parallel ports in order to get screen dumps from my printer. Is there a way I can reconfigure my PC so that the BIOS Print Screen function directs output to LPT2 rather than LPT1?

M. R. Monasterio
Cincinnati, Ohio



There are several ways to attack this problem, but none are as simple as using DEBUG to create a short .COM file that switches the LPT1 and LPT2 I/O addresses stored in the BIOS data area. Start DEBUG and type the following script, which creates SWAP.COM when run:

```
A 0100
MOV AX,40
MOV DS,AX
MOV AX,[08]
MOV BX,[0A]
MOV [08],BX
MOV [0A],AX
RET
```

```
N SWAP.COM
RCX
14
W
Q
```

To redirect Print Screen output to LPT2, type SWAP on the command line. This effectively exchanges LPT1 and LPT2 so that information sent to one goes to the other. To restore the output to LPT1, enter the same command again.

Depending on how its driver was written, you may be able to use the scanner even though the ports have been swapped. If this turns out to be the case, you can add SWAP.COM to your AUTOEXEC.BAT file and leave the LPT1 output per-

■ **SWAPPING LPT PORTS:**
A simple DEBUG script lets you exchange parallel printer ports quickly and easily.

■ **486 STEPPING LEVELS:**
Just like the 386, Intel's 486 CPU has undergone a few revisions in its short life.

■ **CHARACTER ACCENTS:**
A little-used DOS command allows you to enter accented characters with a minimum of keystrokes.

manently directed to LPT2.

How does SWAP work? When Print Screen sends a character to your printer, it calls on another BIOS routine—interrupt 17h function 00h—which takes care of all the details associated with transmitting a byte of data through a parallel port. Just before calling the function, the Print Screen routine places a 0 in register DX, which specifies that output should go to LPT1 (0 corresponds to LPT1, 1 corresponds to LPT2, and so on). In turn, function 00h uses the value in DX as an index into a table of I/O addresses located in memory at 40:0008. The word there holds the I/O address of LPT1. The word immediately following it (at 40:000A) contains the I/O address of LPT2. All SWAP does is exchange the values at these two locations. The Print Screen routine thinks it's sending data to LPT1, but the I/O address that ends up being used is the one corresponding to LPT2. Since at this low level the only thing distinguishing one parallel port from another is the I/O address, printer output is transparently rerouted from LPT1 to LPT2.

The area of memory where the I/O addresses are stored is called the BIOS data area. Since the BIOS is stored in ROM, it can't store data locally. To compensate, the designers of the original IBM PC decreed that the 256 bytes of RAM from 40:0000 to 40:00FF should be reserved for the BIOS.

You'll find all sorts of interesting information in this area. For example, you can look at the word-size value stored at 40:004A to determine how many columns of text are displayed on-screen. The word at 40:0013 reveals the number of kilobytes of conventional memory installed, and the byte at 40:0017 stores the state of the NumLock, CapsLock, and ScrollLock keys. By toggling bits in this byte, you can simulate presses of the corresponding keys. If you're curious to learn more about the BIOS data area and the information stored there, refer to the June 25, 1991, Tutor column.

486 STEPPING LEVELS

In the October 15, 1991, Tutor column, you discussed the stepping levels of the 386 chip. Do 486s also have stepping levels? If so, what were some of the major bugs that Intel corrected?

Robert Dagenais
Laval, Quebec, Canada



Yes, the 486 has undergone stepping levels, just like the 386. The flaws don't necessarily qualify as "major bugs," but there are differences in various versions of the 486—some of them documented, many of them not. For example, encoding for the CMPXCHG instruction (which compares two values and, if they are equal, replaces one with a third number) changed in the B1 step of the 486. Before that, CMPXCHG used the same opcodes as the IBTS and XBTS instructions in early 386 chips. (The instructions were dropped when the 386 went from B0 to B1.)

Some software uses IBTS and XBTS to identify 386 chips with stepping levels

prior to B1. An example of this was given in the February 11, 1991, Tutor column. A utility called 386STEP sniffs out step B0 386s by executing an XBTS instruction and trapping the invalid opcode error, if one results.

Run on a pre-B1 486, a program such as 386STEP may mistakenly think that it's on an early 386, since no invalid opcode exception will occur. This flaw was corrected in the B1 step of the 486 by changing the opcodes for CMPXCHG to values that were never used on the 386.

Another bug in early 486s involved the INS instruction, which reads a series of values from an I/O port. Using INS to read double-word values hangs some 486s if the read operation straddles a double-word boundary. The workaround: When you develop software, make sure all double-word reads performed with this instruction are aligned on even double-word boundaries.

These are but two of the many errata in early 486 chips. Don't panic, though. The bugs are exotic enough that the majority of users will never run into them, and for the most part they've been removed from the latest 486 chip masks. If you experience recurring problems with a 486 PC, unless you happen to have bought one of the first on the market, it is unlikely that your troubles are CPU-related.

To date, the 486 has undergone five major revisions that we know of. The latest stepping level is D0. To my knowledge, there is no surefire way to identify the various stepping levels by markings on the chips themselves—nor does Intel make errata sheets available to the public, probably because it fears the adverse publicity that might result.

The best reference to Intel chip errata I've seen appears in the *PC Magazine Programmer's Technical Reference: The Processor and Coprocessor* (Ziff-Davis Press, 1992), written by former *PC Magazine* senior technical editor Robert Hummel. In it you'll find detailed technical information about the stepping levels of all the Intel microprocessors, and a wealth of other information about Intel CPUs that should be of interest to programmers. If you want to explore the gut-level details of how these chips work, this is one book you won't want to be without.

CHARACTER ACCENTS

A group of handicapped computer users would like to know if you could create a small TSR allowing us to enter accented

vowels with just one or two keystrokes. We'd like, for example, to type an É by pressing E followed with a 1, or é by pressing e followed with 2. Currently, we use *PC Magazine's* KBX utility, but it requires too many keystrokes to pop up the keyboard layout window. Can you help?

Michael Vanky
Port Arthur, Texas



Doing what you describe doesn't require a special utility; the DOS KEYB command already supplies what you need. KEYB is a TSR that remaps the keys to handle other countries'

The bugs in early 486 chips are exotic enough that the majority of users will never run into them.

language conventions. Your DOS manual diagrams all supported keyboard arrangements.

The full KEYB command syntax is

```
KEYB [xx], [yyy], [d:],  
[path]filename]] [/E: [/ID:nnn]
```

where *xx* represents a 2-letter code denoting the keyboard layout you want, *yyy* holds a 3-digit identifier for your selected default *code page* (a table of 256-character bitmaps DOS uses to determine how to display characters on output devices such as screens and printers), *filename* indicates the keyboard definition file DOS supplies (KEYBOARD.SYS), /E (introduced in 5.0) tells KEYB it's running on a 101- or 102-key keyboard connected to an XT-class (8086- or 8088-based) PC, and *nnn* contains a 3-digit ID used if the country you specify in *xx* supports more than one layout (added in 4.0). Only FR (France), IT (Italy), and UK (United Kingdom) use this option.

For your purposes, you need only add the command KEYB BR to your AUTOEXEC.BAT file, unless the location of KEYBOARD.SYS fails to appear

in your path. In this case, you must specify its drive and directory. If, for example, you keep KEYBOARD.SYS on D: in the SYS directory, the command becomes

```
KEYB BR, ,D:\SYS\KEYBOARD.SYS
```

This form of the KEYB command remaps your keyboard to the Brazilian layout if you're using DOS 5.0. It's a good one to use in this country because most of the keys match those used here. After executing the command, you accent a character by preceding it with a special key uniquely assigned to each diacritical mark as follows:

- acute accent (´, for example): apostrophe plus the character;
- grave accent (`): single quotation mark plus the character;
- diaeresis (¨): double quotation mark plus the character;
- tilde (~): tilde plus the character;
- circumflex (ˆ): circumflex plus the character;
- cedilla (¸): apostrophe plus a lower-case letter c.

Under DOS 4.0 or later, you can also load KEYB from CONFIG.SYS using the INSTALL command. On a 386 or 486 running DOS 5.0 and configured to load programs high, you can install KEYB in upper memory with the LOADHIGH command.

Should KEYB interfere with other applications, pressing Ctrl-Alt-F1 will temporarily disable it. Ctrl-Alt-F2 enables it once again.

KEYB is one of the less used DOS commands in the United States, primarily because it's not explained all that well in the DOS manual and not many U.S. users need its services. When the need arises, however, it can make the process of entering characters modified with diacritics much easier. To read more about code page switching on the screen and printer, see the May 15, 1990, Tutor column.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. Questions about DOS and systems in general are answered here. Send your question to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload it to PC MagNet (see page 10 for instructions). We regret that we are unable to acknowledge submissions or answer questions individually. ■

by
Neil J. Rubenking

User-to-User

FINDING A LOST PASSWORD

When using the DOS Shell for MS-DOS 4.01, you can add frequently used programs to the list on the Start Programs screen. You are given the option of choosing a password while making the addition.

Then, if you're like me, you may sit down in front of your computer one day and discover that you've completely forgotten the password. This means that you can no longer run the corresponding program from the Start Programs screen. Nor can you delete the program unless you remember that password.

There is a solution. You can enter the File System and select the SHELL.MEU file in your DOS directory, then view it using the View option in the File menu. Use PgUp and PgDn until you find the name of your program, after which the password will be listed. If you are shut out of a particular group, you must look for its personal *.MEU file and then view it in the same manner.

Seth Thibodeaux
Lafayette, Louisiana

PC This tip holds true for DOS 5.0 as well, with a few changes. In DOS 5.0, the Shell program is DOS-SHELL.EXE, and all of the menu and password information resides in the file DOSSHELL.INI. The fact that the password is so easily visible should give you a clue as to just how little security the password provides.

DOS 5.0 apparently makes an attempt to conceal the password. Characters other than capital letters are replaced by some kind of a code. For example, if you choose the password "pc magazine," the password will appear in DOSSHELL.INI as "VITSGMGFOTK." Must you crack the code if you forget the password? No! If you simply type "VITSGMGFOTK" when prompted for a password, DOS-SHELL accepts it. One has to wonder what the designers of DOSSHELL were thinking.

I'm not a fan of DOSSHELL myself: It

- **FINDING A LOST PASSWORD:** Don't worry if you can't remember your DOS Shell password; it's all too easy to discover what it is.
- **SAVING DOSKEY MACROS:** Combine QBasic and DOSKEY itself for an easy way to save DOSKEY macros.
- **SHELLING TO DOS:** Here's a batch file that does more than tell you if you're shelled out to DOS; it prevents you from accidentally rerunning the parent program.

pales in comparison with a real multitasking system like *DESQView*. But DOSSHELL is free, and you can make it a more practical tool. If you're going to use DOSSHELL, be sure to set the environment variable TEMP to point to a RAM disk. If there's enough room, copy all the DOSSHELL.* files to the RAM disk before executing them. That will speed things up. Do take care to copy DOSSHELL.INI back from the RAM disk to your hard disk before shutting off the system. Until you do that, any changes you've made to your configuration exist only in the copy of DOSSHELL.INI that resides on the RAM disk.

You can also adjust various aspects of DOSSHELL by editing the .INI file directly. Be sure to heed the warning at the top of that file: You must not use a program

that will word-wrap the lines of DOSSHELL.INI. Fortunately, DOS 5.0's own EDIT program is a suitable editor for DOSSHELL.INI. Choose Editor from the DOSSHELL menu, and enter the full pathname of DOSSHELL.INI when asked what file you want to edit. In the editor, you can change the help text associated with menu items, change passwords, even add new items to the menu. If you like, you can devise your own color scheme. Just find the "color = " line and make a duplicate of one of the color selections. Change the name to whatever suits you, and assign your own values to the colors. Now reenter DOSSHELL and choose your new set from the Options/Colors menu item.

SAVING DOSKEY MACROS

I've created a quick and easy way to save DOSKEY macros using a short QBasic or GW-Basic program that automatically inserts the command DOSKEY before every line in a batch file containing the macros. The listing of this program, SAVEMAC.BAS, is shown in Figure 1. Once you have the program, you don't need to do much to make saving your macros automatic. The first step is to create a macro to copy all of your macros into a text file. To do this, just type in the following command (assuming that SAVE-

SAVEMAC.BAS — COMPLETE LISTING

```
10 REM a$="filename for list of macros"
20 a$ = "c:\dos\mac.dat"
30 REM b$="filename for loading macros"
40 b$ = "c:\dos\loadmac.bat"
50 OPEN a$ FOR INPUT AS 1
60 OPEN b$ FOR OUTPUT AS 2
65 IF EOF(1) THEN 200
70 INPUT #1, c$
80 PRINT #2, "doskey " + c$
90 GOTO 65
200 CLOSE 1, 2
210 SYSTEM
```



Figure 1: This BASIC program reads an input file and writes each line to an output file, adding "DOSKEY" to the start of each line.

MAC is in your C:\DOS directory):

```
DOSKEY SAVEMAC=DOSKEY /M $G
C:\DOS\MAC.DAT $T QBASIC /RUN
C:\DOS\SAVEMAC
```

If you then enter SAVEMAC and press return, the file LOADMAC.BAT will be created in your DOS directory. To reload your macros, all you need to do is run the LOADMAC batch file.

If you'd like to load the macros automatically every time you reboot, put the command CALL C:\DOS\LOADMAC in your AUTOEXEC.BAT file. Be sure that it comes *after* your command that loads DOSKEY.

Don Eisele
Fredonia, Kansas



I find DOSKEY macros addictive; whenever I use someone else's machine, I can't understand why my favorite "commands" don't work. After running SAVEMAC, I can copy LOADMAC.BAT and bring my macros with me. One note: The only time you have to run DOSKEY before calling LOADMAC is if you want to load DOSKEY in high memory.

Figure 2 shows the result of running SAVEMAC with several of my DOSKEY macros loaded. I use WHEREIS all the time; it exploits the new abilities of the DOS 5.0 DIR command to locate files matching a template anywhere on the disk. CN is a CD variant to change to a "neighboring" directory; that is, another subdirectory of the parent directory. For example, if I'm in D:\TPW\WINDEMOS and I want to go to D:\TPW\DOCDEMOS, the command CN DOCDEMOS does the job.

How often do you create a new directory and *not* immediately CD into it? MCD is a combination of MD and CD. Typing MCD NEWDIR creates the new directory and immediately moves into it, in one step.

Finally, there's SAVEMAC itself. (Note that SAVEMAC.BAS here is the

name of the program and SAVEMAC alone is the name of the macro that runs the program.) If you're not yet familiar with DOSKEY, a couple of characters in the macro may be confusing. The \$T near the middle separates the macro into two lines.

That's important, because a DOSKEY macro has to fit on a single line. The \$G stands for the > (greater-than) redirection symbol. If you inserted the symbol itself, DOS would interpret it as a request to perform redirection, and would royally screw up your macro definition. In DOSKEY macros, the \$G, \$L, and \$B characters replace >, <, and |.

SHELLING TO DOS

Some of the application programs I use have handy DOS Shell features. I've run into one problem, though: I sometimes forget that I've entered the Shell from a still-running program and type that program's name (or another's) at the DOS prompt instead of typing EXIT. This results in loading—or trying to load—the program in a machine with severely restricted memory.

The easiest way to prevent this, I've found, is to place an EXIT command at the beginning of the batch file that launches each program. For any program that didn't have a batch file, I created one with the name of the original program and then renamed the program. That way I didn't have to learn new commands.

With an EXIT command at the beginning of your major application's batch files, you won't have to remember whether you've shelled out to DOS from a running program. If there is no additional copy of DOS from which to exit, the command has no effect, and execution of the batch file continues as usual.

Bryan D. Feldman
Atlanta, Georgia

WIN.BAT

COMPLETE LISTING

```
@ECHO OFF
EXIT
SET OldPrompt=%PROMPT%
PROMPT [Shelled out of Windows]$_oldPrompt%
WINITSLF %1
PROMPT %oldPrompt%
SET OldPrompt=
```

Figure 3: After renaming WIN.COM WINITSLF.COM, you can use this batch file to avoid loading Windows on top of an already running copy of Windows.



There are a few popular programs that modify the prompt automatically when you shell to DOS. For example, *WordPerfect* puts the line "Enter 'EXIT' to return to WordPerfect" before the prompt. However, in most cases you can't tell by looking at the screen whether you've shelled out. If you forget that you're actually in a secondary command processor, you can be unpleasantly surprised. You'll find that this is especially true if you drop to the DOS command line from Microsoft Windows and then try to rerun Windows.

To avoid this problem, I run Windows from the batch file shown in Figure 3. The batch file's name is WIN.BAT, and I've renamed WIN.COM WINITSLF.COM. Now when I go to the DOS command line from Windows, the prompt reminds me where I am. And if I accidentally type WIN again, the EXIT line at the beginning returns me to the already running copy of Windows.

There's one pitfall to watch out for when you're using this particular batch file. Any time you run Setup from within Windows, it re-creates WIN.COM, so you'll have to delete the file WINITSLF.COM and rename the new WIN.COM WINITSLF.COM. Luckily, you won't have that problem using this strategy with most other programs.

SHARE YOUR SECRETS

Reveal your latest DOS and systems discoveries through User-to-User; we'll pay you \$50 for any submissions we print. Please submit your letter on-disk together with a printout. Mail your contribution to User-to-User, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload it to PC MagNet (see page 10 for access instructions). We regret that we are unable to acknowledge submissions or answer letters individually. ■

LOADMAC.BAT

COMPLETE LISTING

```
doskey WHEREIS=dir $1 /b/s
doskey CN=cd..\$1
doskey MCD=MD $1&CD $1
doskey SAVEMAC=DOSKEY /M $G C:\bat\MAC.DAT $T QBASIC /RUN C:\BAT\SAVEMAC
```

Figure 2: This batch file, produced by SAVEMAC.BAS, contains several DOSKEY macros. You can load them automatically by placing a call to LOADMAC in your AUTOEXEC.BAT.

by
Fran Finnegan

Windows

IS WINDOWS RUNNING?

The Microsoft Windows User's Guide warns us not to run certain programs from a Windows DOS shell; these programs include CHKDSK with the /F parameter, APPEND, and JOIN. But it doesn't tell us how to prevent this from accidentally happening, say, from a .BAT file. And other programs require a command line switch indicating Windows is running; Borland's *Paradox* 3.5 uses the -win parameter for this purpose. Shouldn't these programs be able to determine for themselves whether Windows is running? Since they don't, is there any way to test for this at a DOS prompt or in a .BAT file?

Roy A. Nierenberg
Berkeley, California

PC It is possible for programs to find out whether or not Windows is running, and programs are becoming increasingly Windows-aware over

■ **IS WINDOWS RUNNING?**
A program that tells you at a DOS prompt whether Windows or the DOS 5.0 Task Switcher is running.

time. For example, the DOS 5.0 CHKDSK program detects the presence of Windows 3.1 (but not all modes of Windows 3.0), and it refuses to run with the /F parameter.

Unfortunately, Microsoft hasn't disclosed an "official" procedure for testing for all versions of Windows. Instead, we're left to figure it out for ourselves.

It's really not all that hard to find out whether or not Windows/386 2.x, Windows 3.0, Windows 3.1, or even the DOS 5.0 Task Switcher (which the DOS 5.0

User's Guide and Reference calls the Task Swapper) is running. In fact, I decided to write a program that does just this. WINMODE.C is shown in Figure 1. You can download the executable file by itself from PC MagNet as WINMOD.EXE or together with source code as WINMOD.ZIP. If you don't have access to a modem, you can type in the listing shown in Figure 1 and compile it using Microsoft C 5.1 or later and the following command:

```
cl -AS -Gs -W3 -Zp -Os winmode.c
```

When you run WINMODE at any DOS prompt, it will return one of the ERROR-LEVEL codes in Figure 2. I've arranged the return codes in order of increasing levels of task-switching sophistication. A code of 0 means no task switching is in effect, 1 and 2 represent the Task Switcher (Real- and Standard-mode Windows use

WINMODE.C

```
// WinMode 1.0 for Windows 3.1
// Copyright (c) 1988-92 Finnegan O'Malley & Company Inc.
// All Rights Reserved.
// First Published in PC Magazine, May 12, 1992.

// developed under Microsoft C 5.1

#include <dos.h>
#include <stdio.h>
#include <stdlib.h>

#define INT_MULTIPLEX 0x2F

#define MODE_DOS 0
#define MODE_DOS_TASK_SWITCHER 1 // TS
#define MODE_WINDOWS_3_XX_STANDARD 2 // TS
#define MODE_WINDOWS_386_2_XX 3 // VN
#define MODE_WINDOWS_X_XX_386_ENHANCED 4 // VN

extern int main(int argc, char **argv);

// =====

extern int main(int argc, char **argv);
{
    auto struct SREGS Seg; // segment registers
    static union SREGS Reg; // general registers

    if (argc != 1)
        printf("ts 1.0 for Windows 3.1\n"
            "Copyright (c) 1988-92 Finnegan O'Malley"
            " & Company Inc. All Rights Reserved.\n"
            "First Published in PC Magazine,"
            " May 12, 1992.\n", argv[0]);

    segread(&Seg); // initialize the segment registers

    Reg.x.ax = 0x1680; // in 386 Enhanced mode?
    int86x(INT_MULTIPLEX, &Reg, &Reg, &Seg);
    switch (Reg.h.al)
    {
        case 0x98: // not in 386 Enhanced mode
        case 0x88: // not in 386 Enhanced mode
            break;

        case 0x81: // Windows/386 2.xx is running
        case 0xFF: // Windows/386 2.xx is running
            printf("Windows/386 2.xx is running (%d)\n",
                MODE_WINDOWS_386_2_XX);
            return MODE_WINDOWS_386_2_XX;

        default: // in 386 Enhanced mode, where:
            // AL: major version (3., 4., ...)
            // AH: minor version (00, 10, ...)
            printf("Windows %d.%02d is running in 386 Enhanced"
                " mode (%d)\n", Reg.h.al, Reg.h.ah,
                MODE_WINDOWS_X_XX_386_ENHANCED);
            return MODE_WINDOWS_X_XX_386_ENHANCED;
    }

    Reg.x.ax = 0x4680; // in plain vanilla DOS mode?
    int86x(INT_MULTIPLEX, &Reg, &Reg, &Seg);
    if (Reg.h.al == 0x80) // not in DOS Task Switcher,
    { // Real or Standard mode
        printf("Windows is not running, nor is the DOS"
            " Task Switcher (%d)\n",
            MODE_DOS);
        return MODE_DOS;
    }

    if (getenv("windir")) // in Real or Standard mode?
    || getenv("WINDIR") // (in case it goes upper case)
    {
        printf("Windows 3.xx is running in Real or Standard"
            " mode (%d)\n",
            MODE_WINDOWS_3_XX_STANDARD);
        return MODE_WINDOWS_3_XX_STANDARD;
    }

    // otherwise, the DOS MS-DOS Shell is running
    printf("The DOS Task Switcher is running (%d)\n",
        MODE_DOS_TASK_SWITCHER);
    return MODE_DOS_TASK_SWITCHER;
}

```

COMPLETE LISTING



Figure 1: The C source code for WINMODE.

the same Task Switcher as the DOS 5.0 Shell), and 3 and 4 represent the Virtual 86 mode of the 80386/80486 microprocessor. These codes can be tested for in a .BAT file. For example, to see whether any Windows or DOS 5.0 Shell multitasking may be taking place (return code 1 or higher), the following .BAT file test will tell you:

```
WINMODE
IF ERRORLEVEL 1 GOTO MULTI
ECHO JUST PLAIN VANILLA DOS
GOTO END
:MULTI
ECHO WINDOWS OR MS-DOS SHELL
:END
```

The IF ERRORLEVEL 1 test means "if the previous return code is 1 or higher." If WINMODE returns such a code, either don't run the programs that are dangerous when Windows is running (such as APPEND) or, with programs like *Paradox*, use the command line parameter that indicates Windows is running.

A more complete batch file that would let you test for each of the levels of task switching might take the following form:

```
@ECHO OFF
WINMODE
SET lev=
FOR %tv IN (0 1 2 3 4) DO IF
ERRORLEVEL %tv SET lev=%tv
GOTO label%lev%
:label0
ECHO No Windows or Task Swapper -
do what you like
<do stuff>
GOTO END
:label1
ECHO You can't DO that under Task
Switcher!
GOTO END
... etc
:END
```

To prevent the copyright notice from appearing, you can run WINMODE in a .BAT file as follows:

```
WINMODE >NUL:
```

To determine what kind of task switching is active, all that a program needs to do is perform one or two Multiplex Interrupt (INT 2F) calls and in some cases check for the presence of the environment variable

Even though it is possible to use .BAT files to detect the lowercase "windir" variable in the environment, this isn't a foolproof way to detect multitasking.

windir. You can view windir by entering SET at a DOS prompt within Windows 3.x, but you cannot easily test for it in a .BAT file because it appears in the environment in lowercase letters. Batch files can only access uppercase environment variables; we can only speculate that Windows inserts windir into the environment in lowercase to protect it from being changed by users.

The first INT 2F call in WINMODE (with AX=1600) checks to see if Windows/386 2.x or Windows 3.x 386 En-

hanced mode is running. If neither of these is running, the second INT 2F call (with AX=4680) checks to see if Windows 3.0 is running in Real or Standard mode, if Windows 3.1 is running in Standard mode, or if the DOS 5.0 Task Switcher (also known as the DOS 5.0 Shell, DOSSHELL.EXE) is running.

If one of these is running, a check for the environment variable windir (in both lowercase and uppercase) determines whether it is Windows 3.x or the DOS 5.0 Task Switcher that is running.

The DOS 5.0 Task Switcher is subject to the same "do not run such-and-such a program" warnings that apply to Windows. This is because the DOS 5.0 Shell contains the same task-switching code that is in Windows' Real and Standard modes; see Ray Duncan's Power Programming columns in the issues of October 29, 1991, and November 12, 1991, for details.

Even though it is possible to utilize some .BAT file tricks to detect the presence of the lowercase windir variable in the environment, doing so does not lead to foolproof detection of Windows or the Task Switcher. First, some DOS programs reference the root environment instead of the environment that was passed to them. This may cause these programs or DOS shells loaded by them to miss the windir variable that Windows added to the environment that it creates for DOS shells and programs it starts. Second, if windir is not detected, you still don't know whether or not you are running under the DOS 5.0 Task Switcher.

Since the same "do not run" warnings apply to the Task Switcher, you really do need to look further than just the windir variable to see whether multitasking is present in the current DOS shell. The INT 2F techniques used by WINMODE provide the only foolproof way to check for multitasking.

OPENING WINDOWS

Share your Windows experiences with Fran Finnegan; we'll pay you \$50 for any tip we print. Mail your contribution on-disk, with a printout, to Windows, *PC Magazine*, One Park Avenue, New York, NY 10016, or e-mail it (re: PC Magazine) to PC MagNet: 76244,145; MCI Mail: Fran Finnegan; BIX: franfinnegan; GENie: finnegan; Internet: finnegan@well.sf.ca.us. We regret that we are unable to acknowledge submissions or answer questions individually. ■

WINMODE'S RETURN CODES



ERRORLEVEL	Meaning
0	Windows is not running, nor is the DOS 5.0 Task Switcher.
1	The DOS 5.0 Task Switcher is running.
2	Windows 3.xx is running in Real or Standard mode.
3	Windows/386 2.xx is running.
4	Windows 3.xx is running in 386 Enhanced mode.

Figure 2: The return codes of WINMODE may be checked in a .BAT file by testing for these ERRORLEVELs. The levels are ordered by increasing task-switching sophistication.

by
Craig Stinson

Spreadsheets

STANDARD LABELS

I often need to enter labels into Lotus 1-2-3 worksheets from a set list of label possibilities. This can become tiresome, especially when the labels are long. I have seen algorithms used elsewhere (as in the Search command in the Windows Help system) that require you to enter only the first few characters of the required label. From these first few characters, the algorithm retrieves the required label in its entirety. With this model in mind, I wrote the macro shown in Figure 1. The macro gets its set of label possibilities from the master list shown in B25..B37 of Figure 1. In this example, the list happens to be a breakfast menu, but of course it could be changed to suit any purpose.

To use this macro, place your cursor on the cell where you want to enter the label and press Alt-L. Then begin typing the label. As you type, the macro finds the first label that matches the characters you have entered; if that label is the one you want, press Enter and you're done.

For example, suppose you are making up a breakfast list and wish to enter the label "Continental Breakfast." You would move to the cell where you want to make your entry and press Alt-L. Then you would type C. Immediately, the current cell reflects the label "Croissant," which is the first label matching the character typed in so far. Next, you would type O. At this point, the current cell would display "COntinental breakfast." (All characters actually typed are shown in uppercase.) This is the required label, so press Enter. The current cell then gets the label, exactly as it appears in the breakfast master list.

With this macro, you can also press Backspace to erase the last character typed or Esc to abort the entry. If you press a letter that does not produce a match with any label in the master list, the macro beeps and ignores the character.

Christopher Yiangou
Braamfontein
Republic of South Africa

■ **STANDARD LABELS: A clever 1-2-3 macro that lets you enter labels from a list by typing the first few letters and hitting Enter.**



Actually, in the Windows Help system (and other Windows list boxes), if you press C, Windows takes you to the next item beginning with C. But if you follow that by pressing O, you go to the next item that begins with an O, not to an item that begins with CO. Mr. Yiangou's algorithm is therefore smarter and more useful than the one employed by Windows. Not only does it save keystrokes for the person entering labels, it also ensures accuracy and consistency on the worksheet.

To see how the macro works, let's start by examining the master list. This range is named TABLE and consists of two columns. The label possibilities are in the second column and do not have to be alphabetized. If you alphabetize the labels, the defaults will always be presented in alphabetical order (for example, "Continental Breakfast" will be proposed before "Croissant"), but this isn't essential and may not even be desirable. To the left of the label possibilities is a column of logical formulas that look like this:

```
+ $BUFF=LEFT (B25, @LENGTH ($BUFF))  
+ $BUFF=LEFT (B26, @LENGTH ($BUFF))
```

and so on. These formulas produce a set of flags that each return either 1 or 0. A flag returns 1 if the current contents of the cell named BUFF match the adjacent master-list entry (we'll come back to BUFF in a moment). Otherwise, the flag returns a 0. (Exception: Each flag also returns a 1 when BUFF is blank, but that's of no consequence.)

Meanwhile, a cell named LOOKUP (B3) uses an @VLOOKUP formula to return the first master-list entry whose flag cell happens to be a 1. As we'll see, LOOKUP's role will be to store the first master-list entry whose beginning matches the user's keystrokes, and to supply that entry to the current cell (the one in which the user invokes the macro) as soon as the user presses the Enter key.

Now, the plan of attack is as follows: Each character the user types (following the initial Alt-L) is received in the cell named KEY (B2). After receiving a character, the macro checks to see if the character is a Backspace, Esc, or Enter. If it's a Backspace, the macro branches to a routine called REMOVE, which produces an audible beep, erases the most recent character, and loops back to accept another character. If Esc is pressed, the macro does a /RE and quits. If Enter is pressed, the macro branches to a finish-up routine called COMMIT.

If the character is none of the above, the character is concatenated onto the end of the entry in the cell named BUFF (B2). BUFF is blank at the beginning of the macro run (the macro's first instruction enters a null string into BUFF). But as the user types, BUFF accumulates characters passed to it from KEY.

Each time BUFF gets a new character from KEY, the macro checks to see if the current contents of BUFF match the beginning portion of a master-list entry. If they do, the macro loops back to accept another keystroke. If they do not, the macro branches to REMOVE, which (as noted before) beeps, lops off the most recent character, and loops back to receive another.

After each keystroke has been received by KEY, the cell where the user pressed Alt-L is updated with the current value of ENTRY (B6), which itself is a concatenation of the cell named PREFIX (B4) and the cell named SUFFIX (B5).

PREFIX is cleverly designed to store either a null string or an all-caps version

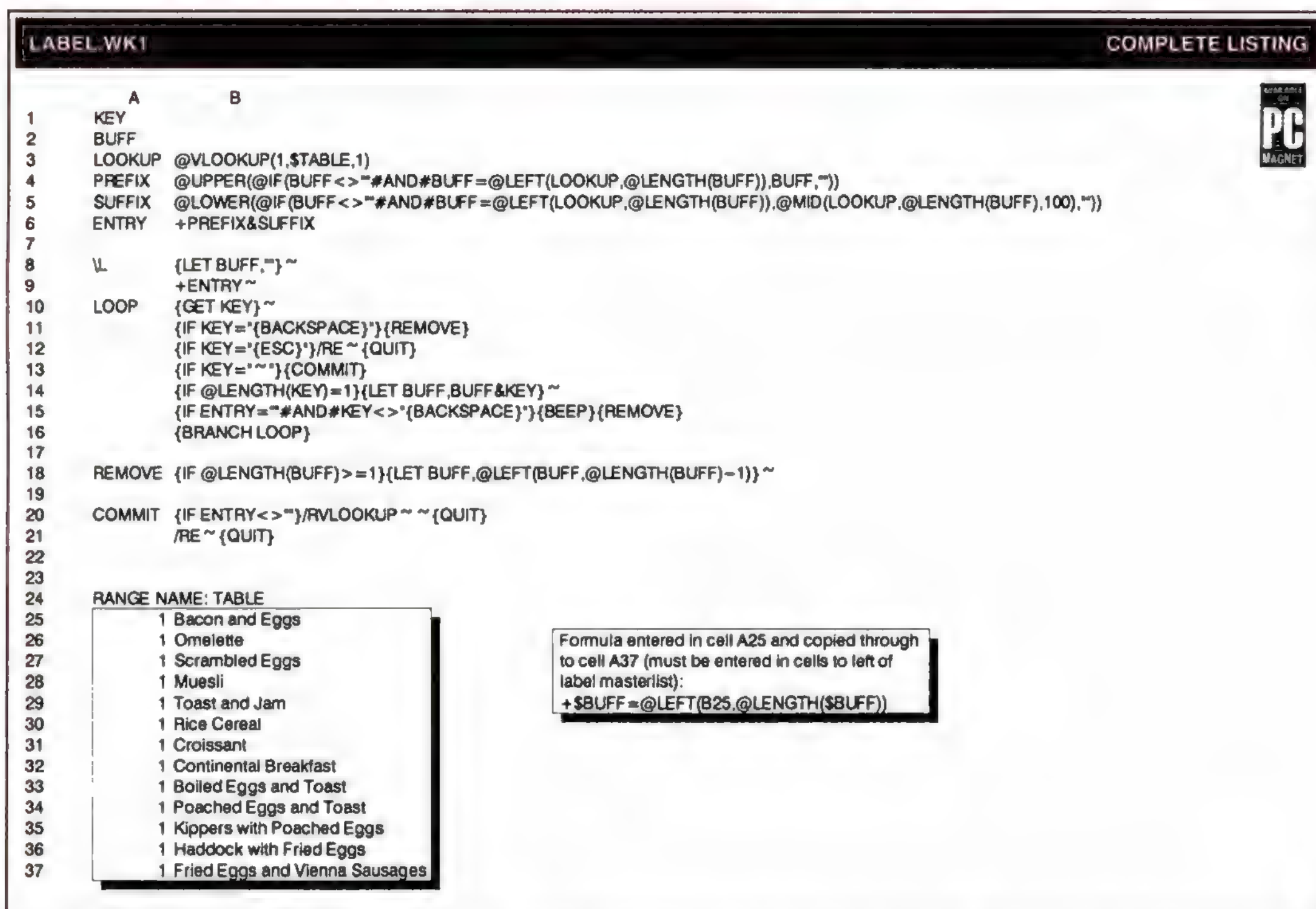


Figure 1: If you have a set of labels you need to use repeatedly, this macro will let you enter each label you need simply by typing the first letter, or enough characters to distinguish it from the others.

of the current contents of BUFF. It stores a null string if the current contents of BUFF don't match the beginning of a master-list entry; otherwise, it stores BUFF (in all uppercase characters). SUFFIX, which is also cleverly designed, stores either a null string or a lowercase version of the rightmost *n* characters of LOOKUP, where *n* equals 100 minus the length of BUFF.

Thus, as the user types, the current cell contains the value of ENTRY (which consists of the first matching master-list entry) in a mixture of upper- and lowercase letters. The characters the user has typed appear in capitals (thanks to PREFIX), and the remainder of the first matching label appears in lowercase (thanks to SUFFIX). When the user presses Enter, the macro heads off to the COMMIT routine, which uses a /Range Value command to copy LOOKUP into the current cell. This step serves two purposes: It locks in the value of LOOKUP (so sub-

sequent changes to LOOKUP won't affect the current cell), and it restores the capitalization style of the master-list entry (for example, changing "CONTinental breakfast" back to "Continental Breakfast").

This macro's text-finding algorithm is smarter than the one used by Windows.

When creating this macro, start by creating all of the range names, since you won't be able to enter formulas with references to undefined range names. Note that Figure 1 lists the formulas in B3..B7

as labels so that you can see the text of the formulas rather than their results. Be sure to enter these as formulas, not labels. Also, note that Figure 1 lists the results of the formulas in B25..B37, not the text. We structured the figure this way to conserve space in the listing and to show how these formulas operate as logical flags. Be sure to enter the formulas as exemplified in the text to the right of the master list.

HINTS, TIPS, QUESTIONS

Share your latest spreadsheet discovery through *PC Magazine's* Spreadsheets column. We'll pay you \$50 for any tip we print. Please submit your letter on-disk, together with a printout. Mail your contribution to Spreadsheets, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload it to PC MagNet (see page 10 for access instructions). We regret that we cannot acknowledge submissions or answer questions individually. ■

by
M. David Stone

The Working Word

DATE AND TIME STAMP

Entering the date and time manually can be a bit of a chore, even in programs like *Word for Windows 2.0* that include commands for inserting the date and time. Here's a simple macro for *WinWord* that will let you enter both date and time in a single keystroke.

To create the macro, first decide on the format you want. For this example, I'll use the format *January 1, 1992--3:30 PM*, which you would represent with *WinWord*'s Date-Time Picture switch as

```
MMM d, yyyy-h:mm AM/PM
```

Next, create the macro by choosing Tools Macro, entering an appropriate name such as *DateTimeStamp*, choosing Edit, and entering the line

```
InsertDateTime .DatePicture =  
"MMM d, yyyy-h:mm AM/PM"
```

between the Sub MAIN and End Sub statements. When you're finished, close the macro window, use the Tools Options command to attach the macro to the Toolbar, menus, or a shortcut key, and give the File Save All command to save your changes.

Jacob Stone

Doylestown, Pennsylvania



Because almost anyone can make good use of a date-time stamp in a macro, I'll expand this discussion to include *WinWord*, Version 1.x, and *WordPerfect*.

The macro feature in *WinWord 1.x* differs somewhat from that of Version 2.0. In particular, there is no *InsertDate* command. To create the equivalent macro in Version 1.x, choose Macro Edit, enter the macro name, choose OK, and enter the command

```
InsertField "Date \G" + Chr$(34) +  
"MMM d, yyyy-h:mm AM/PM" +  
Chr$(34)
```

■ **DATE AND TIME STAMP:**
Macros that insert the
date and time in
WinWord 1.x and 2.0 or
WordPerfect.

between the Sub MAIN and End Sub statements. You have to use Chr\$(34) to indicate quotes in the date field you're inserting, because WordBASIC recognizes quotes as having special meaning to the InsertField command.

There are also some considerations that apply to any version of *WinWord*. The Date-Time Picture switch allows great flexibility in specifying the date format. You can include the full month name with the four-letter code MMMM as shown here, or a three-letter abbreviation with the three-letter code MMM, a two-digit number 01 through 12 with the code MM, or a number from 1 to 12 (with no leading zeros) with the code M.

WinWord 2.0 users can find the codes for specifying the date and time format in *WinWord*'s Help: Search in the Help Index for the Date-Time Picture switch. *WinWord 1.x* users can find the relevant information beginning on page 117 of the User's Reference. Note that you can also add other characters, such as the double hyphen in this example, between the date and time. In this case, I would add a colon and space after the time so that the cursor winds up right where you want to start typing the note.

There is an important limitation in both versions of this macro, however. The macro does not actually enter a date and time into your document. Instead, it enters a *field*. *WinWord* will update the field every time you print—defeating the whole point of a date-time stamp—unless you lock the field first. You can let the macro lock the field by adding the following three lines immediately after

the line that enters the date field.

```
LeftChar 1  
LockFields  
RightChar 1
```

This will move the cursor back into the field, lock the field, and then move the cursor back to its original position.

You can also create a macro for a date-time stamp by recording the macro, using any of the choices for creating fields manually, and typing Ctrl-F11 to lock the field or fields. (Depending on what you record, you may get separate fields for the date and time.) The resulting macro will be less elegant than the one I've discussed here, but it will still do the job.

WordPerfect users will find no difference between recording a macro for a date-time stamp and creating one by editing it, except that recording will be far easier. To record the macro, type Ctrl-F10 to turn on macro recording, and enter a macro name and optional description. Then type Shift-F5, choose Date Format (just Format in Version 4.2), and define the format, referring to the on-screen list for your choices. To match the format we've been using, you would enter

```
3 1, 4--8:9 0:
```

This format is in effect until you change it or quit. Finish by hitting Enter, then choose Date Text (Insert Text in Version 4.2) to insert the date as text and Ctrl-F10 to end the recording. No need to worry about locking fields: *WordPerfect* enters the date as text.

TIPS FROM WORKING WORDSMITHS

Tell the Working Word your latest word processing discovery; we'll pay you \$50 for any tip we print. Please send your contribution on-disk along with a print-out to The Working Word, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload it to PC MagNet. ■

by
Frank J. Derfler, Jr.

Connectivity

DOWNSIZING? FIND THE SOFTWARE FIRST!

Our parent company uses an IBM mainframe and Xerox's XBMS, which provides our inventory, order, sales, receivables, and general ledger management. We're considering going it alone using some type of PC network.

It seems as if a peer-to-peer type of network would suit our needs better than a server-based setup. Could you offer some ideas?

Bruce Hunter
via CompuServe



Don't worry about the network yet. First find the accounting software you want, then look for a network solution that works with it. Scan the review "Downsizing to LAN-Based Accounting" in the October 15, 1991, issue of *PC Magazine*. The Price Waterhouse experts present an exhaustive discussion of nine major networked accounting packages and their features.

When it's time to select networking software, note that the Editors' Choice from that review, *Macola Accounting Software*, and the honorable mention, *The IBM Platinum Series*, both run over Btrieve, a database engine that comes with Novell's *NetWare*. Other excellent products in that review will run over less expensive networking packages like Artisoft's *LANtastic* (602-293-6363), Performance Technology's *POWERLan* (512-349-2000), or Tiara Computer Systems' *IONET* (415-965-1700).

You'll probably face a high cost for the installation of new network cabling, but since you use IBM 3270 terminals, it's likely that you already have RG-62 coaxial cable in the walls. ARCnet LAN adapters will let you reuse it. While standard ARCnet uses the relatively slow signaling speed of 2.5 megabits per second, it works fine in typical business networks with dozens of nodes. Datapoint Corp. (512-593-7000) will start shipping its new 20-Mbps ARCnetPlus adapters in mid-



1992, so think twice before installing new network cabling.

Any networking software will work over ARCnet adapters like those from Standard Microsystems (516-273-3100), but you'll have to check with Datapoint Corp. to determine compatibility between the networking software you choose and its ARCnetPlus adapters.

SERVER RELIABILITY VS. COMPATIBILITY

I'm about to purchase a LAN for my business. I've been told that there's a distinction between equipment made by different tiers of hardware manufacturers. Information I've seen indicates that vendors on lower rungs produce equipment that's less *fault-tolerant*, as they describe it, but I'm not certain what that means. Can you shed some light on the topic?

Matthew Kunkin
via CompuServe



Fault tolerance is the ability some systems have to suffer partial failure but continue reliable operation. Special design, special engineering practices, and plain old redundancy all provide fault tolerance in different ways. Some LAN operating systems like *NetWare*, for example, provide a way to mirror disk drives so all reads and writes

take place on two drives simultaneously. If one fails, the other carries the load. Certain types of disk drive arrays use the same concept but with four or more drives. Redundant disk drives, power supplies, and even servers provide instant fault tolerance.

A LAN can create its own degree of fault tolerance, if you take care in its design. You can both load application files on local PCs and make frequent backups of the server's shared files, thus achieving a kind of long-term fault tolerance at low cost. The ability to restore a server from tape in a couple of hours is enough fault tolerance for many organizations.

I've never found a satisfactory way to distinguish among the type of PCs you should consider as a server based on mean time between failure. Regardless of the nameplate, there's an amazing similarity among basic components that are the common sources of failure, like power supplies and hard disk drives. If you filter the AC power, keep smokers away, get the dust bunnies out, and keep the room cool, you're doing everything you can do to prolong the server's life.

Compatibility far overshadows reliability as a consideration in selecting a server. You can get warranties and guarantees of reliability, but conjuring compatibility is an arcane art. The memories of our years at PC Magazine LAN Labs are full of products that didn't work together—but we rarely experienced an equipment failure. If you're worried about fault tolerance, I think you need a local systems integrator to install and support your network.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay you \$50 for any tip we print. Please submit your letter on-disk along with a printout. Mail your contribution to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016. ■

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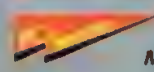
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Bill Machrone,
Editor-in-Chief,
September 11, 1990



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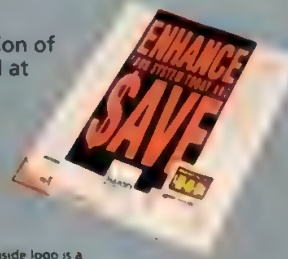


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by
Craig Kerwien

PC MagNet

FINDING ARTICLES

Since the beginning of 1991, *PC Magazine* has published more than 85 reviews covering over 1,600 products. That's a lot to keep track of, especially when you're looking for information about a product and you don't want to spend a couple of hours trying to find it in a back issue. Fortunately, there's a way to find what you're looking for in a matter of minutes: You can go on-line to PC MagNet and ZiffNet.

ZiffNet offers the Product Reviews Index, an on-line index to reviews in *PC Magazine*, *PC/Computing*, and *PC Week*. The index can be searched by product name, company name, or topic of interest. When you find the reference you're looking for, you'll see the standard article abstract, including article title, date, page number, and a list of topics. You also have the ability to narrow your search when the initial results are too unwieldy.

To save yourself even more time, the following suggestions should help:

- Use specific strings in your search request to get concise answers, because the index matches phrases on a "begin with" basis. Entering just a few letters of a unique phrase may also give you the right citations, while entering a whole word invites spelling discrepancies, which would render your search fruitless.
- Don't worry about capitalization, because the searches are not case-sensitive.
- Don't search for large categories such as "comparison" or "computer," because there are usually too many articles fitting those descriptions.

Once you've found a citation, you can log off and look up the article in your personal library, or stay on-line and retrieve the full text of the article in Computer Database Plus (COMPDB). This is a database containing the full text and abstracts from more than 130 computer-related publications, including *PC Magazine*, *PC/Computing*, and *PC Week*.

When you find the citation you want in the Product Reviews Index, take note of the unique article number on the bottom.

■ **FINDING ARTICLES:**
PC MagNet provides several ways to find the magazine article you're looking for.

COMPDB has a special feature to search for just that article, thus minimizing your on-line charges. Most of the searching is performed with menus and is easily understandable. Response time is very fast, and you should see the first results of your query within seconds.

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- Articles may now be downloaded directly to your PC using a transfer protocol such as Xmodem or CIS B+, so you don't have to learn arcane scrolling commands. To download, type `DOW n` (where *n* is the number of the article you want to receive) at the citation list of articles that met your search criteria. You may also type variations, such as `DOW 1-5` and `DOW 1-5, 9` to get more than one article.
- Scrolling an article for text capturing is still possible; just type `S` when viewing the first page of the article.
- The proximity operator `NEAR` has also been changed, so you can search for words and phrases within a specified distance of each other in either direction. For example,

`hypertext near10 graphic*`

will find all occurrences of the word *hypertext* that are within ten words of words beginning with the string *graphic*.

In case you need product information that is not covered by *PC Magazine*, Computer Directory (COMPDIR) is a searchable database of more than 72,000 computer-related products from more than 12,000 vendors, including listings for

minicomputers and mainframes and their peripherals. COMPDIR lets you search for products by category, price, or vendor. Vendor profiles include each firm's name, address, principal company officers, yearly revenue, and product category. Like COMPDB, Computer Directory is quite fast, and you'll get nearly instantaneous results to your queries.

PC MagNet also offers a downloadable index of *PC Magazine* product reviews so that you don't have to go on-line whenever you need to look up a citation. `PCM.EXE` is a self-extracting file available from the Utilities/Tips Forum (type `GO ZNT:TIPS` to get to this forum) in library 1 (General Information). When downloaded and uncompressed, this file can be searched for all the citations from January 1990 to the present. You'll also need to download `PCSRCH.EXE`, which contains the search engine. `PCM.EXE` is updated twice a year.

PRICING AND NAVIGATION

You can access the ZiffNet Product Reviews Index with no extra connect-time charges by typing `GO ZNT:INDEX` from PC MagNet or CompuServe.

Computer Database Plus costs \$15 per hour in addition to the standard connect charges, plus \$2.50 per article retrieved (\$1.50 if the summary is not available). Computer Database Plus can be accessed by typing `GO ZNT:COMPDB` at the CompuServe prompt.

Computer Directory access costs \$15 per hour in addition to the standard connect charges, plus \$1 to view the list of products or companies that meet your search criteria and 25 cents to see an individual item. Computer Directory is available by typing `GO ZNT:COMPDIR` at the CompuServe prompt.

You can access ZiffNet and PC MagNet from any CompuServe ! prompt by typing `GO ZIFFNET` or just `G ZNT`. If you're not already a member, see the sign-up instructions on page 10 of this issue. ■

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Computer Buyer
February 1992

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Info World
March 16, 1992

BOTTOM LINE

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Desktop Communications
February 1992

PC Magazine
March 17, 1992

HOT PRODUCT
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PC Magazine
March 17, 1992

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This is the future of Windows printing.

Windows Watcher
January 1992

If you're tired of waiting for Windows to print, the LaserMaster WinPrinter can help eliminate output bottlenecks, and give you overall performance and print quality that is easily equal to other 4-page-per-minute printers.

PC Publishing & Presentations
November 1991

PC Sources
December 1991

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CIRCLE 237 ON READER SERVICE CARD

by
Douglas Boling

Utilities

SPRINTER Adds a Flexible Cursor Speedup to Your PC

If you can remember the mainframe days, you won't have forgotten the crisp text, excellent function-key layout, and unbeatable keyboard feel that made the IBM 3778 terminal such a pleasure to use. The 3778 feature I've missed the most since moving to a PC, however, is the ability to speed up the cursor simply by holding down the Shift key while pressing the cursor movement keys.

SPRINTER.COM is a tiny (1K) TSR (terminate-and-stay-resident) program that will add this cursor-accelerator feature to your PC. For maximum flexibility, it gives you a choice of Alt, Ctrl, or Shift to use as your accelerator key, and it lets you select from among a wide range of speed-up rates. When the accelerator key is held down, the speed step-up is applied to the four Arrow keys and to the PgUp and PgDn keys.

Like other keyboard-related TSRs, SPRINTER won't work with applications that take over the keyboard interrupt (interrupt 9). Unfortunately, Windows takes over that interrupt when it starts. While it won't hurt to leave SPRINTER installed when Windows is running, SPRINTER will have no effect on Windows applications. SPRINTER can be run in Windows DOS boxes to quicken the cursor in any applications running there, however, provided those programs do not themselves take over interrupt 9. Some DOS applications bypass the BIOS and thus bypass SPRINTER, too. And SPRINTER won't work with *WordPerfect's* Cursor Speed feature. To prevent problems, I've included a disable/enable switch so you can safely leave SPRINTER loaded and apply it to all programs that can use it.

Instructions for downloading an executable copy of SPRINTER from PC MagNet are given in the sidebar "Downloading Utilities." The assembly language source file, together with the executable, can be downloaded as SPRINT.ZIP. If your modem setup can't handle binary files, you can download SPRINT.BAS, which, when run in BASIC, will create a

■ The old IBM 3778 mainframe terminal had a handy cursor-accelerator key that PCs never had—until now.

copy of SPRINTER.COM. And if you are without a modem, the source code is available by mail or fax. Just send a postcard with your name and address to Katherine West, Utilities, *PC Magazine*, One Park Ave, New York, NY 10016. You'll need an assembler compatible with Microsoft's MASM 2.0 to construct the executable file from the source.

USING SPRINTER

SPRINTER has six optional command line parameters. Its complete syntax is

```
SPRINTER [/K xx] [/S n] [/O] [/D]
[/B] [/P]
```

By default, SPRINTER is installed and enabled with the Alt key (left or right) as its accelerator key when you run the program at the DOS prompt or in your AUTOEXEC .BAT file. The /K xx switch can be used to change the accelerator as follows:

```
/K S Either Shift key
/K LS Left Shift key
/K RS Right Shift key
/K A Either Alt key
/K LA Left Alt key
/K RA Right Alt key
```

```
/K C Either Control key
/K LC Left Control key
/K RC Right Control key
```

Note that the accelerator key choice can be changed after SPRINTER has been loaded. Simply run SPRINTER /K xx with the new xx value; SPRINTER will find the installed copy of the TSR and change the combination.

The /S n option lets you determine the degree to which SPRINTER accelerates the cursor. The speed can be set with values of n from 1 to 9, the default being 2. A speed of 9 will make the cursor almost leap across the screen. Like all SPRINTER command options, the acceleration speed can also be reset after SPRINTER has been installed.

The /D option temporarily disables SPRINTER. This can be handy when you are running a program incompatible with SPRINTER's direct access to the BIOS keyboard buffer. The /E parameter reenables the utility. The /U command uninstalls it. Remember, all TSRs must be removed in the reverse of the order in which they were installed. The final command line option, /?, brings up a help screen that describes the proper syntax for each of the command line parameters.

HOW SPRINTER WORKS

It will be helpful to begin by reviewing how the keyboard, the keyboard controller, and the BIOS work together to pass keystrokes to the system. The PC keyboard consists of a matrix of mechanical switches. Each switch is checked every few milliseconds to see whether anyone

DOWNLOADING UTILITIES

The *PC Magazine* utilities are available by modem from PC MagNet, our on-line service.

To find the telephone number nearest you, dial 800-346-3247 using your modem. When the modem connects, press the Enter key. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you. Or you can call 800-635-6225 and follow the instructions and note the number.

Set your communications software to 300, 1,200, or 2,400 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex.

Dial the local number. When you connect, type Ctrl-C. At the HOST NAME prompt, type CIS. At the USER ID prompt, type 177000,5000. Type PC*MAGNET at the PASSWORD prompt. At the ENTER AGREEMENT NUMBER prompt, type PCMAG92.

Register your name and enter your MasterCard, Visa, or American Express card number. (If you'd like to

have your company billed instead, call CompuServe customer service at 800-848-8990.)

Your personal user ID and a temporary password will be displayed. A new password will arrive in the mail within ten days to confirm your subscription.

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PC MagNet costs \$12.80 an hour for 1,200- or 2,400-bps service, or \$6.30 an hour for 300-bps service. Billing is based on 1-minute increments.

These programs can be copied but are copyrighted. You may make copies for others as long as no charge is involved, but making copies for any commercial purpose is prohibited. ■

has pressed a key, which closes one of the switches. Checking each key to see if it is pressed is a time-consuming process, and if the computer's central processor (the 286, 386, or 486) on the motherboard had to do the job, it wouldn't have time to do much else.

For this reason, the task of checking the keys is turned over to an additional microprocessor (called a *microcontroller*), which is built into the keyboard unit. The keyboard microcontroller is actually a single-chip computer that has its own ROM, RAM, and I/O ports. It runs a single, monotonous, unchanging program burned into its ROM that checks each key every few milliseconds. The microcontroller communicates with the PC through the keyboard cable, using a serial protocol.

On today's standard keyboard there are over 100 keys, which would suggest that the keyboard microcontroller would need that many I/O lines in order to check each switch individually. Actually, however, the controller can get by with only eight I/O lines.

The keyboard keys are wired in a matrix

in which each key is connected to the intersection of a row and a column line. Each switch can thus be addressed (and checked) by selecting its row and column address. The controller I/O is wired so that most of its lines are connected to row and column decoders. A decoder is a chip that takes in a four-bit number and activates one of 16 output lines. After the row address is written, the controller sends each of the column addresses. The keyboard controller spends its life repeatedly scanning each of the keys in this manner. When a key is down, an additional line from the keyboard back to the controller is lowered, and a last I/O line is used to select whether the number from the microcontroller is being sent to the row decoder or the column decoder. (This brief example assumes a generic PC keyboard; the concepts are implemented a little differently for different keyboard designs.)

The difference between the mechanical world (in which things are measured in fractions of seconds) and the electrical world (in which things are measured in fractions of microseconds) presents the

keyboard controller with an additional task. When a key is pressed, there is always a certain amount of mechanical bounce at the bottom of the keystroke. While no human would notice it, the keyboard controller is fast enough to register each bounce as a separate keystroke. Since this is obviously not desired, the keyboard controller "debounces" the keyboard by accepting only key closures that have been held for enough scans that the key has finished bouncing.

The keyboard controller reports the keypress to the system as a scan code that can be read by the system microprocessor. The controller sends at least two codes for every keystroke: a *make* code when the key is pressed and a *break* code when it is released. If the key is held down for a preset amount of time (usually about half a second), the controller sends extra make codes (without intervening break codes) to produce the *typematic* action of the keyboard.

When a scan code is sent to the system, the system microprocessor is interrupted with IRQ1, mapped as interrupt 9h. The system BIOS reads the scan code from the I/O port, matches it to an appropriate ASCII code, and places the scan code/ASCII combination in the BIOS keyboard buffer. If the scan code corresponds to a shift key (Alt, Ctrl, or Shift) instead of to a standard key, the scan code is discarded and the BIOS sets the proper bits in the keyboard status byte in the BIOS data area. If the keyboard buffer is full when an interrupt 9 occurs, the BIOS beeps the speaker.

The 32-byte keyboard buffer is located in the BIOS data area in segment 40h. The buffer itself is usually located at offset 1Eh of the BIOS data area. Pointers to the beginning and end of the buffer are kept in locations 80h and 82h, also in the BIOS data segment. Since the keyboard buffer pointers are near pointers (no segment is specified), the buffer can be moved, but it must remain in the BIOS data segment.

The buffer operates on a first in, first out (FIFO) basis. It uses two additional pointers to point to the head and to the tail of the buffer. The head pointer points to the next scan code to be removed from the queue, while the tail pointer points to the last scan code placed in the buffer. When these pointers are equal, the buffer is empty. This design results in the keyboard buffer being able to hold a maximum of 15 keys.

While the discussion so far has been

about a generic PC, a few model-specific comments are in order. In the original IBM PC, the keyboard controller was located in the keyboard unit and the action took place as described above. When IBM introduced the PC AT, the keyboard interface was radically redesigned.

The AT keyboard interface retained compatibility with established I/O port addresses and scan codes, but it added an additional keyboard controller chip on the motherboard. This added intelligence allowed implementing two-way communication between the system and the keyboard. This is how the shift indicator bits on the AT and PS/2 keyboards can be turned on and off by system command.

The AT interface added a standard set of keyboard controller commands to the keyboard interface. The system could now send commands to the keyboard to perform specific tasks, such as performing a self-test, resending the last code, and setting the shift indicator lights. It certainly seems like overkill to add an extra microcontroller just to flip some lights, but it is rumored that the original design of the AT keyboard included a small LCD panel that didn't make the final design. This proposed LCD may explain the elaborate communications protocol that the AT and subsequent PCs have used ever since.

FROM HARDWARE TO SOFTWARE

When an application program (or DOS) wants to read from the keyboard, it uses the interrupt 16 BIOS's keyboard services. The INT 16 routines allow programs to wait for a key, check whether a key is available, and check the shift state of the keyboard.

When an application wants to read a key, it calls the Keyboard Read function (INT 16, AH=0). If a key is in the buffer, the call returns with the scan code in AH and the ASCII character in AL. If there is no key in the buffer, the function does not return until a key is available.

One interesting feature of BIOSes since the AT is that before the BIOS enters its loop to wait for a key, it calls the system Wait function (INT 15, AH=0) with BL=2. This notifies the operating system that the current program is waiting for a key and needs no processing time until a key is available. When a key is pressed, the BIOS calls the Post function (INT 15, AH=91) to tell the operating system that a key is now available and that the application should be restarted.

For programs that don't want to wait

for a key, the Keystroke Status function (INT 16, AH=1) can be used both to indicate whether a key is in the buffer and to provide the scan code and ASCII character of the key. Programs that loop on this call waiting for a key should always yield control of the system if a key is not available. A program can yield control by calling the DOS Idle interrupt (INT 28) and by calling the release timeslice call (INT 2F, AX=1680). The release timeslice call originally used in the OS/2 1.x DOS box is also used by Enhanced-mode Windows and OS/2 2.0.

The state of the shift keys can be read by calling the Shift Status function (INT 16, AH=2). This function returns the state of the Shift, Ctrl, Alt, NumLock, CapsLock, and ScrollLock keys. The function differentiates between the left and right Shift keys but does not differentiate between the left and right Ctrl and Alt keys. The extended keyboard functions must be used to determine which Alt or Ctrl key has been pressed.

When IBM created the Enhanced 101- or 102-key keyboard late in the life of the PC AT, new BIOS keyboard functions were added that mapped the original Get Key, Key Status, and Shift Status functions. The Extended Keyboard Read func-

tion (INT 16, AH=10) is identical to the Keyboard Read function except that this new function will return any extended key codes in the keyboard buffer.

The Enhanced 101-key keyboard (the one with the extra "inverted T" cursor keys) added a number of keys to the standard PC keyboard. These new keys are usually mapped to their duplicated counterparts on the standard keyboard. For example, the Enter key on the keypad of the Enhanced keyboard is normally indistinguishable from the Enter key next to the letter keys. The two Enter keys can be differentiated by using the Enhanced Keyboard Read function, if desired.

When one of the new keys is pressed, the keyboard controller sends two scan codes. An E0h extended scan code is sent first, immediately followed by the old scan code corresponding to the matching key on the old keyboard. The keyboard BIOS translates this 2-byte scan code by using the same ASCII equivalent, with an E0 replacing the old scan code used on the AT keyboard. For example, the regular Enter key scan code is 1C, which would be represented in the keyboard buffer as 1C0D (the scan code combined with the ASCII carriage-return code). If the number-pad Enter key is pressed, the controller sends the 2-byte scan code E01C, which is represented in the keyboard buffer

PC MAGAZINE UTILITIES UPDATES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. You can get the modified versions by downloading them from PC MagNet. Here's a partial list of the programs that have been upgraded to fix bugs and system incompatibilities. If the filename is longer than six letters, search on the first six letters, using the same extension.

ANSI.COM, Version 1.3
BAT2EXEC.COM, Version 1.5
BCOPY, Version 1.2
Benchmark Series, Version 6.0a (BEN60A.EXE)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.5
CMDEDIT.EXE, Version 2.8
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 3.1
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1

PANDORA.COM, Version 2.4
PCACCESS.EXE, Version 1.1
PCMANAGE.EXE, Version 1.1
RN.COM, Version 3.0
SCHEDULE.COM, Version 1.1
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
TPFST-AT.COM, Version 1.1
ZCOPY.COM, Version 1.4

For a complete list of all the programs available from the PC MagNet Software and Utilities Database Library, download PCMCAT.ZIP.

A downloadable index to *PC Magazine's* product reviews is also available. PCM.EXE is a self-extracting file that contains the *Computer Library PC Magazine Reviews Index* for January 1988 to June 1991. It requires the search files in PCSRCH.EXE. Please read the information file PCM.INF before you download these files. ■

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CIRCLE 263 ON READER SERVICE CARD

PROGRAMMING

UTILITIES

as E00D. When an application uses the standard Read Keyboard function (AH=0), the BIOS automatically translates the E00D key code in the key buffer to 1C0D in order to remain compatible with the old AT keyboard. To return the true E00D scan code, the Enhanced Keyboard Read function would have to be used.

As indicated above, the Extended Shift Status function (INT 16, AH=12) lets applications determine whether the left or the right Alt or Ctrl key was pressed. The function returns an extended shift status in AH to complement the standard shift-status byte in AL. The extended shift status also allows applications to use the SysReq key as a Shift key, since its shift status is also returned in AH.

Some seldom-used BIOS keyboard functions are not supported on all machines. For example, the Set Typematic Rate functions (INT 16, AH=3) are supposed to allow applications to adjust the typematic settings of the keyboard. Originally introduced on the PCjr, this function has several subfunctions designed to set and read the typematic rate.

Unfortunately, this function is supported only on a limited set of systems. To determine whether the function is supported, an application should call the Keyboard Functionality Determination function (INT 16, AH=9). This function returns a status byte in AL that indicates which of the set-and-read typematic functions are supported. Ironically, like the typematic functions themselves, this function is only supported on a limited set of machines. To determine if this function is supported, the Return System Configuration Parameters function (INT 15, AH=C0) must be used. (It would seem that the IBM BIOS designers had some time on their hands when they were adding functions to the original AT BIOS!)

A potentially useful function, Keyboard Write (INT 16, AH=5), lets applications insert a scan code into the keyboard buffer as if it had been typed on the keyboard. Unfortunately, this function was included only in the AT BIOSes dated after November 1985. Since it's not always available, most applications (including SPRINTER) write to the keyboard buffer directly to stuff a key.

THE SPRINTER CODE

SPRINTER works by intercepting both the Timer (INT 8) and Keyboard (INT 9)

interrupts. In a nutshell, SPRINTER detects the proper shift conditions, sets a flag, and lets the timer interrupt push extra scan-code combinations into the keyboard buffer.

The SPRINTER keyboard interrupt routine reads the scan codes directly from the keyboard I/O port 60h. If the key matches either the PgUp, PgDn, or Arrow keys, and if the code is a make code, the scan code is stored. If the scan code is a break code, the stored scan code is cleared.

If the scan code corresponds to any of the shift keys, it is converted into a bit flag that corresponds to the bits in a shift-status byte kept inside SPRINTER. Again, if the code is a make code, the bit corresponding to the shift key is set; otherwise the bit is cleared.

If one of the cursor keys is detected while the correct shift key is pressed, the interrupt routine resets the interrupt controller and performs an IRET instead of passing control to the BIOS routine. This prevents programs that use that shift-cursor combination from performing other actions. If a cursor key is pressed after the shift key, then neither the cursor nor the shift scan code is discarded.

The timer interrupt routine looks to see whether the proper shift combination is pressed along with a cursor key. If it is, the timer routine stuffs the proper scan code into the keyboard buffer the number of times indicated by the keyboard speed parameter. The frequency of the timer interrupt (18.2 times per second) multiplied by the key speed parameter permits an accelerated keystroke rate of from 18 to 163 keys per second.

The installation and removal of SPRINTER follows standard TSR procedures. The program finds itself in memory by performing a compare of the first 16 words of every segment. To ensure that the search doesn't stumble across an image of the program in a disk buffer, the first word of the program is zeroed before the search begins.

SPRINTER shows that while the mainframe terminal was well designed, it is the programmability of the PC that makes it an unbeatable productivity tool. The days of the time-share terminal have drawn to a close, but that doesn't mean you have to lose all the desirable features that went with the territory. ■

Douglas Boling is a contributing editor to PC Magazine.

by
Douglas Boling

Lab Notes

In the previous issue we reviewed the basic concepts of serial communications. This time, we'll discuss their specific implementations in today's PCs.

To provide for the full needs of a serial port, including the associated control lines for RS-232 communication, requires the services of a chip called a Universal Asynchronous Receiver/Transmitter (UART). The processor controls the UART by writing to its registers. The National Semiconductor INS-8250 UART was used in the original PC, and its register set has become the de facto standard for all serial ports on PC compatibles.

The starting address for the UART I/O ports will vary with the COM port being used. The original PC and PC-XT specified two serial ports, the first starting at I/O address 3F8h and the second port at I/O address 2F8h. The IBM PS/2 *Hardware Technical Reference* specifies eight possible serial ports with corresponding register locations. The PC BIOS keeps a list of the base addresses for the first four serial ports in the BIOS data area, starting at address 40:0h.

Sending data out through the serial port is a simple matter of writing the data bytes to the UART's Transmit Data register. Data the UART receives is made available to the processor in the Receive Data register. The CPU can poll the UART to determine when to read or write data to it, or, for maximum efficiency, the UART can be programmed to interrupt the CPU when data needs to be written or read.

The register set for the 8250 family of UARTs is shown in Figure 1. There have been three major revisions of this register set, all backward-compatible with earlier versions. The different shadings in the figure indicate which registers are included in each version. The figure also shows the functions of the individual bits in each of the registers, as well as their offset from the base address of the UART.

The Transmit Data and Receive Data registers are the first members in the 8250 set. If the processor writes a value to the

Putting Serial-Port Technology in Perspective, Part 2

■ While the PC BIOS provides a serial-port interface, its services are limited. Hence, programmers have taken to writing directly to the UART. Here, we take an in-depth look at this chip.

Transmit Data register, the 8250 will immediately copy the data into an internal register and shift it out the transmit line of the serial port. The Receive Data register returns the last data to be received on the Receive Data line of the serial port. Note that if the Receive Data register is not read before the next byte has been received, the byte currently in the Receive Data register will be lost. The 8250 detects this condition and sets the overrun bit in the Line Status register.

The 8250 can be programmed to interrupt the processor when data needs to be read from the Receive Data register or written to the Transmit Data register. The Interrupt Enable register determines the conditions under which the UART will interrupt the processor. Specifically, the chip can be programmed to interrupt when it needs data, when the modem-status lines change, or when an error condition is detected. The modem-status interrupts occur whenever the Data Set Ready (DSR), Clear to Send (CTS), Data Carrier Detect (DCD), or Ring Indicator (RI) line has changed.

The error conditions detected are framing errors, parity errors, overrun errors, and break detection. When the processor reads the Interrupt Identification register, the reason for an interrupt can be determined.

The primary control register for the 8250 is the Line Control register. The bits in the Line Control register control, among other things, the size of the data word, the number of stop bits, and the parity configuration. The data word size can be configured from five to eight bits, and one or two stop bits can be selected. Odd, even, or stick parity can also be set.

Bit 7 of the Line Control register controls access to the Baud Rate Divisor registers. When this bit is 1, the I/O address that normally accesses the Transmit Data and Receive Data registers and the Interrupt Enable register accesses the Baud Rate Divisor register instead.

The Baud Rate Divisor register is a 16-bit counter that determines the speed at which the 8250 transmits and receives data. To set the baud rate on a PC, the 8250 is driven by a 1.8432-MHz clock. With each clock cycle the Divisor register is decremented by one count. When the Divisor register reaches 0, the counter is reset and one bit of data is transmitted to or received from the UART.

Different baud rates can be set by placing different values in the Divisor register. A value of 96 (60h) in the register causes the 8250 to operate at 1,200 baud, for example. Putting a value of 12 in the Divisor register will result in a baud rate of 9,600. While the original PC only supported baud rates up to 9,600, the baud rate can be set to a maximum of 115,200

by using a divisor of 1. Note that the baud rate and bps rate are the same in a purely digital circuit such as that of the UART.

The Modem Control register allows the processor to set the RS-232 control lines that link the computer and modem. Bits 1 and 0 control the state of the modem's Request to Send (RTS) and Data Terminal Ready (DTR) lines. Bit 4 of this register loops the output of the transmitter back into the receiver, allowing the CPU to test most of the UART circuitry. Two general-purpose lines, Out 1 and Out 2, are provided. Out 1 is not used for PC serial ports, but Out 2 provides an additional control over the serial interrupt. The Out 2 bit must be set if the UART is to interrupt the processor, regardless of the state of the Interrupt Control register.

The Line Status register lets the processor read the state of the UART. When in a polling mode, the processor reads this register to determine when to read or write a byte of data from or to the UART. Any error conditions in the UART are also indicated in the Line Status register.

The Modem Status register can be read to determine the state of the DCD, RI, DSR, or CTS line. The register also contains bits that are set when the state of any of those lines changes. This allows the processor to determine whether any of the lines has changed state since the last time the register was read.

UART UPGRADES

The first upgrade on the 8250 was the 16450 UART, used in the PC AT. The 16450 provides a faster interface between the UART and the processor, but its only functional difference from the 8250 was the addition of a scratch register where the processor could store a byte of data. The PC Convertible, IBM's first laptop computer, used an 8250A, which is functionally identical to the 16450.

With the release of the PS/2 models in 1987 came the 16550 UART. Here the story gets a little muddy. The original PS/2 Models 50, 60, and 80 used an early version of the 16550 with a bug that disabled its main feature: a set of FIFO (first in, first out) queues that would have dramatically improved serial performance.

The 16550 was replaced by the 16550A in the PS/2 Model 70. This fixed the bug in the FIFO section of the chip; improved versions of the Models 60 and 80 also use the 16550A. But the only way to determine if the 16550s in the PS/2 can use the FIFO queues is to test the serial chip. To



THE 8250 REGISTER SET

Address

Read
7 6 5 4 3 2 1 0

0 Receive data

Write
7 6 5 4 3 2 1 0

0 Transmit data

Read
7 6 5 4 3 2 1 0

1 Interrupt enable
0 0 0 0 MS LS T R

Enable receive data ready INT
Enable transmit holding register empty INT
Line status INT
Enable modem status INT

Read
7 6 5 4 3 2 1 0

2 Interrupt ID FIFO 0 0 ID I

Interrupt pending

00 Char mode
01 DMA
10 Reserved
11 FIFO mode

000 Modem status
001 Transmit data
010 Receive data
110 FIFO timeout

Write
7 6 5 4 3 2 1 0

2 FIFO control FIFO size 0 0 0 TR RR FE

FIFO Size
00 1 byte
01 4 bytes
10 8 bytes
11 14 bytes

Transmit FIFO reset
Receive FIFO reset
FIFO enable

Read
7 6 5 4 3 2 1 0

3 Line control D B SP EP P S Word size

00—5 bits
01—6 bits
10—7 bits
11—8 bits

Word size
Number of stop bits
Parity enable
Even parity
Stick parity
Set break
Access divisor latch



THE 8250 REGISTER SET (CONTINUED)

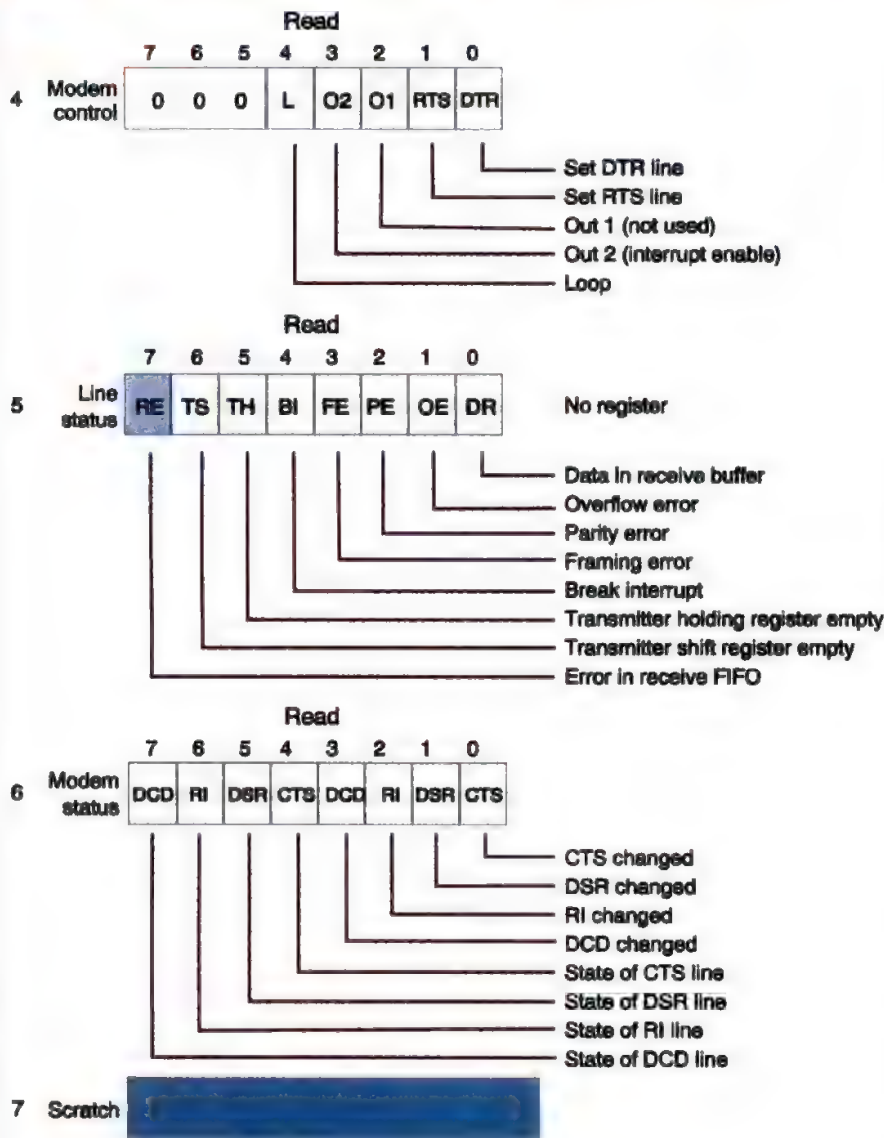


Figure 1: There have been three major revisions of this register set. Dark blue indicates the changes that resulted from the first upgrade, the 16450 and 8250A chips. Light blue shows the revisions that accompanied the 16550. Pink shows the changes introduced with the IBM Type 3 serial port. Addresses 0 and 1 are also used for the Baud Divisor Latch Register.

confuse matters further, while improved versions of the PS/2 Model 50 incorporate the 16550A, IBM does not support using the FIFO queues on the Model 50!

The FIFO queues of the 16550A represent a significant development for serial communications. Faster serial-port and modem speeds mean that the CPU must

spend more and more of its attention servicing the UART. For example, while the processor must read the UART every 6 milliseconds for a serial port at 1,200 baud, it must read the UART every 83 microseconds at 9,600 baud. This increased load is compounded by multitasking operating systems such as Enhanced-mode

Windows and OS/2. In a multitasking operating system, the computer may be too busy to service the serial port.

This is where the FIFO queues come in. The queues consist of small buffers that hold up to 16 bytes of data. After filling the transmit FIFO queue with 16 bytes of data, the processor will not bother with the serial port again until all 16 bytes have been transmitted. The receive FIFO queue works the same way. When the 16550A UART needs service, the processor can read the last 16 bytes of data received. By using the FIFO queues, a 16550A UART running at 9,600 baud needs only the same service time as a 16450 UART running at 600 baud.

One additional register and several control bits have been added to the Interrupt Enable and Interrupt ID registers in the 16550A. The additional register is the write-only FIFO Control register. This register enables the transmit and receive FIFO queues, clears the queue contents, and sets the interrupt trigger level of the queues.

The 16550A can be set to interrupt the processor when the receive FIFO queue holds 1, 4, 8, or 16 bytes of data. Although the processor is interrupted when the appropriate level is reached, the UART continues to store its data in the FIFO queue. This allows the operating system enough time to complete its current task before having to service the UART.

The Interrupt ID register in the 16550A UART has been expanded to encompass interrupts from the FIFO queues. Bits 6 and 7 indicate whether the UART is in FIFO mode. Bit 3 indicates that the interrupt was caused by a character time-out condition in the receive FIFO queue. This interrupt allows the processor to read the last few words in a serial transmission when there are not enough data words received to trigger a FIFO full interrupt.

Using the FIFO queues in a serial communications program is really quite simple. Once initialized in FIFO mode, the UART will wait until the FIFO queue is full before interrupting the processor for service. The interrupt routine repeatedly reads the Receive register until the queue is empty. On the transmit side, a communications program writes enough words to the UART to fill the transmit FIFO queue. The UART will then not need data to transmit until the transmit FIFO queue has been exhausted.

To determine whether the UART in a computer contains usable FIFO queues, a program only needs to set some bits in

the UART register and check the response. The assembly language routine, SERTYPE, in Figure 2 determines if the FIFO queues are available.

The routine in Figure 2 first sets bit 0 of the FIFO Control register and then reads the Interrupt Identification register. If bits 6 and 7 are both 0, the UART is a 16550 and the FIFO queues should not be used. If the bits are both 1, the UART is a 16550A and the queues can be used.

If the 16550A is detected, the PC identification bytes are checked to see if the computer is a PS/2 Model 50. If it is a Model 50, the routine indicates that the FIFO queues are not found, since this PC does not support FIFO mode. The routine then goes on to check for the presence of an enhanced DMA serial port. The new DMA serial port is the latest and most exciting development in PC serial ports.

DMA SERIAL PORTS

The improvements provided by FIFO queues can be significantly augmented by adding DMA support to the serial port. DMA support does more than just dump serial data into a buffer; it can scan the incoming data for special characters, and it can

even provide its own flow control. On the IBM side, the new PS/2 Models 90, 95, and 57 incorporate the enhanced DMA serial ports, and other manufacturers either have done so or will.

The enhanced serial port also breaks one of the historic PC barriers by allowing the use of a faster baud clock. By setting a bit in one of the enhanced registers, the standard 1.8432-MHz clock can be switched to 11.0592 MHz. This raises the theoretical serial rate to 691,200 bits per second. As with earlier serial ports, the IBM models do not support the highest possible speed, but they set their limit at 345,600 bps, which is still very fast.

One of the difficulties of providing DMA support for a serial port is the need to scan for control characters among the received data. Normally, this process uses the CPU to compare a received data byte with a set of known control characters. With the DMA feature active, however, the processor may not read the received data until the DMA buffer is filled.

To avoid any wait for processor service, the enhanced serial port has com-

pare registers that can be used to check for up to three special control characters. When such a character is found, the UART can be programmed to start or stop transmitting automatically, to delete the character, to interrupt the processor, or any combination of these events.

The new DMA serial port (a Type 3 serial port, in IBM lingo) is backward-compatible with the earlier 8250 family of UARTs. While all previous registers are present, an entirely new set of registers has been added to control the enhanced features. The new registers are accessed by adding 8000h to the base address of the start of the conventional UART register set. For example, if a serial port normally starts at I/O address 3F8h, the enhanced register set will start at 83F8h. Figure 3 shows the new registers used by the Type 3 serial port. Their description will serve as something of a programmers' reference.

The first of the enhanced registers, the Command register, controls the transmission of data in DMA mode. Data sending can be stopped and restarted, and any error conditions can be reset using bits 1 and 0 of the register. All of the

SERTYPE ROUTINE			PARTIAL LISTING		
<pre> ; SERTYPE - A routine to determine the type of UART used in a ; serial port. ; ; Entry: DX - Starting I/O address of the serial port ; Exit: AX - Type of serial port ; 0-8250 ; 1-16450, 16550, or 8250A ; 2-16550AF with FIFO queues ; 3-IBM Type 3 serial port with DMA </pre>			<pre> inc ch ;Assume type 2 mov dx,bx add dx,8003h ;Point to enhanced reg 1 cli in al,dx push ax or al,01000000b ;Enable DMA transmit mode out dx,al push dx mov dx,bx add dx,2 in al,dx mov cl,al pop dx ;Restore Enhanced reg 1 pop ax out dx,al sti and cl,0c0h ;Again mask all but FIFO ID cmp cl,40h jne sertype_1 inc ch ;Must be type 3 sertype_1: pop ax mov dx,bx add dx,4 out dx,al ;Point to modem ctl reg xor ax,ax ;Restore initial condition mov al,ch mov dx,bx pop cx pop bx sertype endp code ends begin </pre>		
<pre> sertype proc near push bx push cx mov bx,dx ;Save starting I/O addr add dx,4 ;Point to modem ctl reg in al,dx ;Disable interrupts push ax and al,11111011b ;Disable serial interrupt by out dx,al ;clearing Out 2 bit. mov ch,0 ;Assume type 0 mov dx,bx add dx,7 ;See if scratch reg exists mov al,55h cli out dx,al ;Write to scratch reg jmp \$+2 in al,dx ;Read back cmp al,55h jne sertype_1 mov al,0aah out dx,al ;Write to scratch reg jmp \$+2 in al,dx ;Read back sti cmp al,0aah jne sertype_1 inc ch ;Assume type 1 mov dx,bx add dx,2 ;Point to FIFO ctl reg mov al,7 ;Attempt to enable FIFOs cli out dx,al jmp \$+2 in al,dx ;Read interrupt ID reg sti and al,0c0h ;Strip all but FIFO bits jz sertype_1 ;If bits 0, 16450 or 16550 </pre>					

Figure 2: This short routine can be used in a program to test whether your PC's UART supports FIFO queues.

other bits in this register are reserved.

The Interrupt ID register identifies all interrupts that can occur in both conventional and enhanced modes. In enhanced DMA mode, new sources of interrupts include Terminal counts on the transmit or receive DMA controllers or a compare register match on the received data.

Enhanced Function Register 1 controls the enabling of the DMA modes of the UART. This register also enables

interrupts for the serial port, including DMA terminal count notification. Bit 5 of this register forces the UART to store a byte of status information with every byte of received data. By enabling this mode, you can half the number of data bytes that can be kept in the FIFO and DMA buffers, but it allows the processor to check the status of each data byte

when it reads the DMA buffer.

Enhanced Function Register 2 controls the baud clock and enables hardware flow control. Bit 7 paces the transmit rate, using the Receive Count register. Bits 5 and 4 cut the transmit and receive rate of the UART by a factor of 16, slowing the UART so that slower processors can keep up with the serial port. Bit 6 of this register determines whether the 1.8432- or 11.0592-MHz baud clock

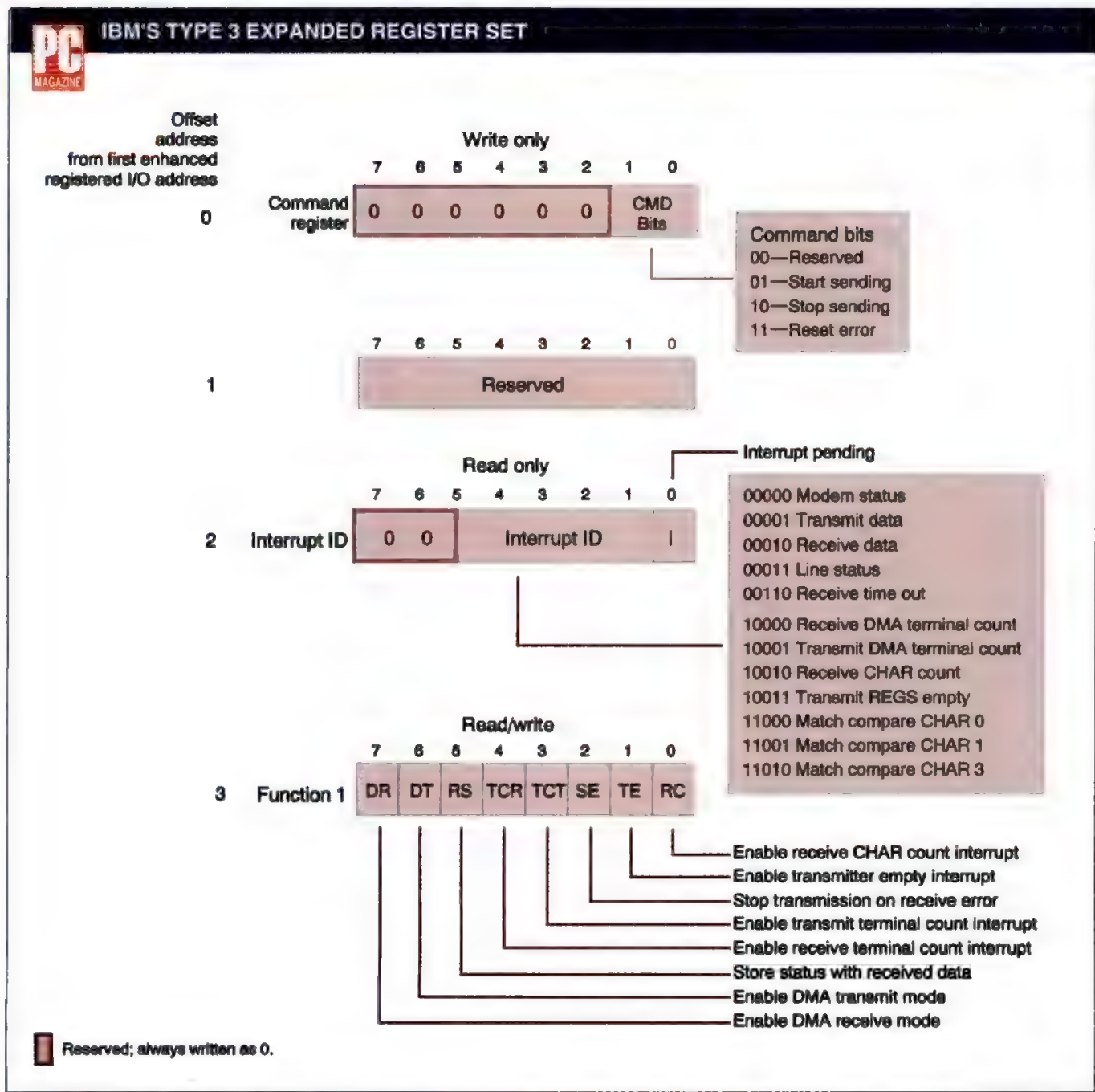
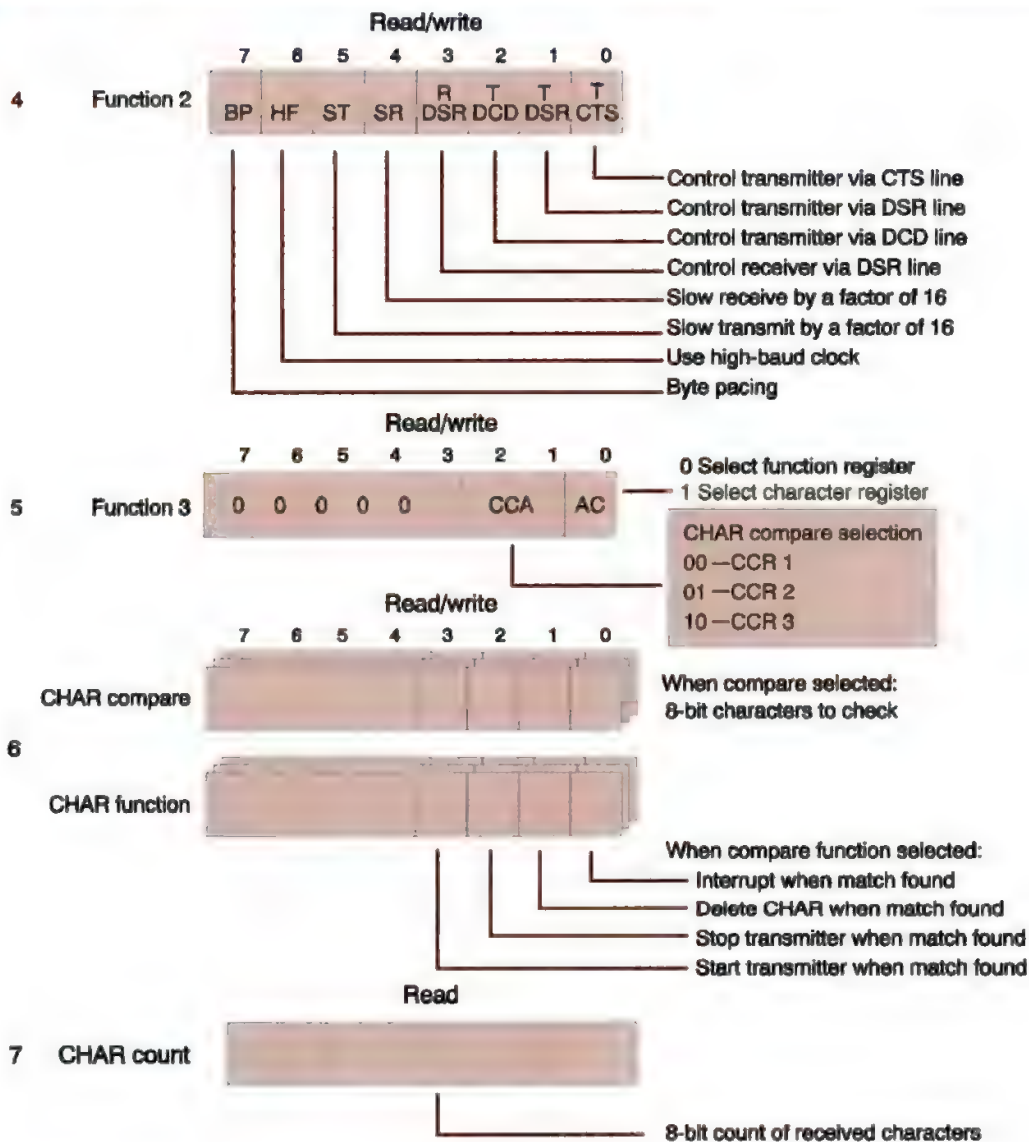


Figure 3: The DMA serial port, or Type 3, is backward-compatible with the earlier 8250 family of UARTs. This illustration shows the new registers used to control the enhanced features, such as flow control and a faster baud clock.



IBM'S TYPE 3 EXPANDED REGISTER SET (CONTINUED)



is used. Finally, the lower four bits of this register determine the hardware flow control of the serial port. When these bits are set, the UART will stop and start transmitting and receiving in accordance with the DSR, DCD, and CTS status lines.

Enhanced Function Register 3 controls access to the character compare registers. Bits 2 and 1 select which of the character compare registers is accessed. Bit 0 selects the character compare register or its accompanying character function register. The character compare register is the actual 8-bit byte to check. The character compare function register selects which

event should occur when a matching character is found.

After setting the Enhanced Function Register 3 to access the proper character compare register, that register can be read and written at that character compare register address. If a character compare function register is selected, only bits 3–0 are used. More than one event can be programmed for each character match by enabling multiple events in a Character Compare Function register.

The final register in the enhanced register set is the Receive Character Count register. This register has two functions. The

first is to keep a tally of the bytes received by the UART. The other is to act as a pacing register for transmitting data. When in the pacing mode, the UART slows transmission of data by dividing the baud clock by 256 times the value in this register.

The FIFO queues and DMA interface that enhance the performance of serial communications have their counterparts in the world of parallel ports, which will be the subject of a future Lab Notes. ■

Douglas Boling is a contributing editor to PC Magazine.

by
Charles Petzold

Environments

Creating a Computer Drum Machine, Part 2

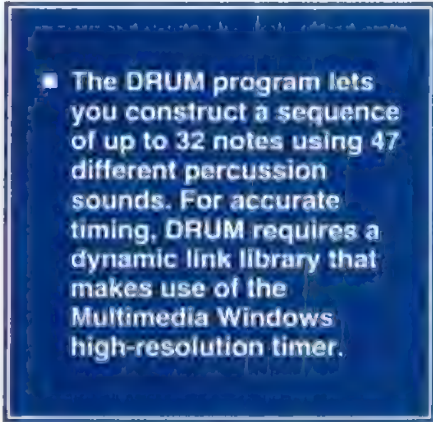
The standard Windows timer is certainly easy to use. Just call `SetTimer`, specifying an elapsed time in milliseconds, and you'll receive `WM_TIMER` messages periodically. It's a fine facility for clock programs and even for simple animation.

For time-critical applications, though, the Windows timer is a disaster. In the first place, the timer is based on the PC system clock, which means that you can't receive `WM_TIMER` messages more frequently than every 55 milliseconds or with an elapsed time that is not a multiple of 55 milliseconds. Second, the timer messages are not asynchronous. They come through the program's message queue, and processing may be delayed if another program is at work. Third, because a message queue can hold only one `WM_TIMER` message at any time, you're not even guaranteed that you'll get all the timer messages you expect.

Playing music is one such time-critical application for which the Windows timer is simply inadequate. I tried to get away with it in the BACHTOCC program discussed in the April 14, 1992, column, but it was obvious that using the Windows timer was not a good solution, and I admitted that at the time. Now it's time to do the job right.

In the previous issue I began discussing a drum machine program written for Microsoft Windows with Multimedia Extensions. DRUM uses the percussion channel on an electronic music synthesizer conforming to the Musical Instrument Digital Interface (MIDI) specification. The program will also run under Windows 3.1 (which includes Multimedia Extensions) if you have a MIDI board and a driver for it.

As shown in Figure 1, DRUM lets you interactively create a percussion pattern by clicking on a grid that represents 47 percussion sounds and 32 beats. You can also adjust the velocity (which generally corresponds to the volume), the tempo (as fast as 10 milliseconds per beat), and the number of beats in the sequence. In



■ The DRUM program lets you construct a sequence of up to 32 notes using 47 different percussion sounds. For accurate timing, DRUM requires a dynamic link library that makes use of the Multimedia Windows high-resolution timer.

this column I'll discuss a dynamic link library called `DRUMDLL` that DRUM uses to play the MIDI sequence.

THE MULTIMEDIA TIME FUNCTIONS

To provide the accuracy we need to play MIDI sequences on the PC, Multimedia Windows includes a high-resolution timer that is implemented using seven functions beginning with the prefix *time*. One of these functions is superfluous; `DRUMDLL` demonstrates the use of the other six.

The timer functions work with a callback function located in your code, specifically in a dynamic link library that your program uses. This callback function is called by the timer device driver according to a timer delay value specified by the program.

When dealing with the multimedia timer, you specify two different times, both in milliseconds. The first is the *delay time*, and the second is called the *resolution*. You can think of the resolution as a tol-

erable error. If you specify a delay of 100 milliseconds with a resolution of 10 milliseconds, the actual timer delay may range anywhere from 90 to 110 milliseconds.

There is sometimes a terminology problem when talking about resolution. The higher the resolution, the lower the time value. For example, a 5-millisecond resolution is higher than a 10-ms. resolution. To avoid this problem, I'll use the words *higher* and *lower* in conjunction with the term *resolution value* to indicate a numerical relationship. For example, a 5-ms. resolution value is lower than a 10-ms. resolution value.

Before you use the timer, you should obtain the timer device capabilities:

```
timeGetDevCaps (&timecaps, wSize) ;
```

The first parameter is a pointer to a structure of type `TIMECAPS`, and the second parameter is the size of this structure. The `TIMECAPS` structure has only two fields, `wPeriodMin` and `wPeriodMax`. These are the minimum and maximum resolution values supported by the timer device driver. If you look at these values after calling `timeGetDevCaps`, you'll find that `wPeriodMin` is 1 and `wPeriodMax` is 65535, so this function may not seem crucial. It's a good idea, however, to get these resolution values anyway and use them in the other timer function calls.

The next step is to call

```
timeBeginPeriod (wResolution) ;
```

to indicate the lowest timer resolution value that your program requires, within

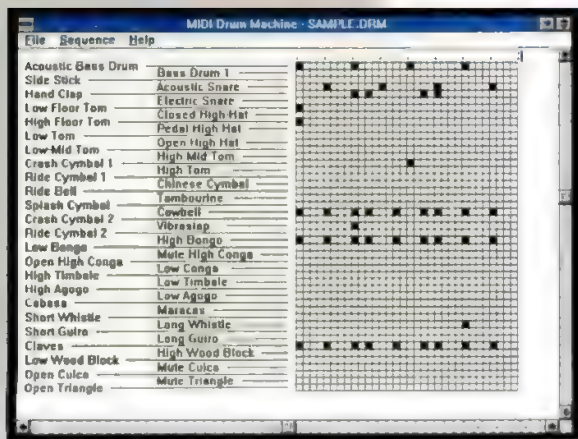


Figure 1: DRUM lets you interactively create a percussion pattern by clicking on a grid.

the range given in the TIMECAPS structure. This call lets the timer device driver best provide for multiple programs that may be using the timer. Every call to `timeBeginPeriod` must be paired with a later call to `timeEndPeriod` (which we'll get to shortly).

Now you're ready to set a timer event:

```
wTimerID = timeSetEvent (wDelay,
    wResolution, CallBackFunc,
    dwData, wFlag) ;
```

The `wTimerID` return from the call will be 0 if an error occurs. Following this call, the function `CallBackFunc` will be called from Windows in `wDelay` milliseconds with an allowable error specified by `wResolution`. The `wResolution` value must be greater than or equal to the resolution value passed to `timeBeginPeriod`. The `dwData` parameter is program-defined data, which is later passed to `CallBackFunc`. The last parameter can be either `TIME_ONESHOT`, to get a single call to `CallBackFunc` in `wDelay` milliseconds, or `TIME_PERIODIC`, to get calls to `CallBackFunc` every `wDelay` milliseconds. I'll discuss `CallBackFunc` shortly.

To stop a one-shot timer event before `CallBackFunc` is called, or to halt periodic timer events, call

```
timeKillEvent (wTimerID) ;
```

You don't need to kill a one-shot timer event after `CallBackFunc` is called.

When you're finished using the timer

in your program, call

```
timeEndPeriod
    (wResolution) ;
```

with the same parameter passed to `timeBeginPeriod`.

Try not to be greedy when specifying resolution values in these timer function calls. Selecting a 1-ms. resolution requires that the timer device driver process timer hardware

interrupts every millisecond. This can cause a serious drain on the rest of the system.

Two other functions begin with the prefix `time`. The function

```
dwSysTime = timeGetTime () ;
```

returns the system time in milliseconds since Windows first started up. The function

```
timeGetSystemTime (&mmtime, wSize) ;
```

requires a pointer to an `MMTIME` structure as the first parameter and the size of this structure as the second. Although `MMTIME` can be used in other circumstances to get the system time in formats other than milliseconds, in this case it always returns the time in milliseconds. So `timeGetSystemTime` is superfluous.

THE TIMER CALLBACK FUNCTION

As I mentioned, the multimedia timer works by calling a callback function located in a dynamic link library that your program uses. The address of the callback func-

tion is passed as a parameter to `timeSetEvent`. The timer device driver calls the callback function during hardware timer interrupts. This has several important implications:

- The callback function must be located in a dynamic link library, and it must be exported. (The easiest way to export the callback function is to use the `_export` keyword when defining the function.) Unlike the case with other callback functions used in Windows, you don't need to call `MakeProcInstance` for the callback.

- As stated in the documentation, the code segment in which the callback function resides must be fixed in memory, and any data that it uses must be in a fixed data segment. Segments are flagged as fixed or movable in the dynamic link library's module definition file. The segments must be defined as fixed so they are not swapped out to disk and require reloading during the interrupt.

- The callback function is limited in the Windows function calls it can make. The callback function can only call `PostMessage`, four timer functions (`timeSetEvent`, `timeKillEvent`, `timeGetTime`, and the superfluous `timeGetSystemTime`), two MIDI output functions (`midiOutShortMsg` and `midiOutLongMsg`), and the debugging function `OutputDebugStr`.

- And remember, don't even think about making any DOS function calls from the callback function.

As you can see, the multimedia timer is designed specifically for playing MIDI sequences and is limited in its usefulness beyond that. You can use `PostMessage` for informing a window procedure of timer events, and the window procedure can do whatever it likes with the information, but it won't be responding with the accuracy of the timer callback itself.

The callback function has five param-

DRUMDLL.DEF

COMPLETE LISTING

```

;-----
; DRUMDLL.DEF module definition file
;-----

LIBRARY      DRUMDLL

DESCRIPTION  'DLL for DRUM Program (c) Charles Petzold, 1992'
EXETYPE      WINDOWS
CODE         PRELOAD FIXED NONDISCARDABLE
DATA         PRELOAD FIXED SINGLE
HEAPSIZE     1024

EXPORTS      WEP @1 RESIDENTNAME
```



Figure 2: This is DRUMDLL's module definition file.

eters, but only two of them are used: the timer ID number returned from `timeSetEvent` and the `dwData` value originally passed as a parameter to `timeSetEvent`.

THE DRUMDLL SOURCE CODE

The source code for the DRUMDLL dynamic link library is shown in Figures 2 through 6. All source code for DRUM and the DRUMDLL dynamic link library can be downloaded from PC MagNet. If you want to recreate DRUMDLL.DLL using the Microsoft C 7.0 compiler, run

```
MAKE DRUMDLL.MSC
```

With the Borland C++ 3.0 compiler, use

```
MAKE -f DRUMDLL.BCP
```

If you're familiar with the compiler flags for these two products, you'll notice that DRUMDLL.C is compiled for C++ mode. Although I'm not using any C++-specific code in DRUMDLL.C, adding such code is easier if you don't have to make further changes to account for the better type checking in C++.

Currently, it appears as if the retail version of Microsoft C 7.0 will include much of what is now included in the Windows 3.0 Software Development Kit (SDK), but beta versions have not included the multimedia MMSYSTEM.H header file or MMSYSTEM.LIB import libraries. These files, however, are being included in the beta version of the Windows 3.1 SDK, indicating that the separate Multimedia Development Kit (MDK) is being phased out. It's not clear now how all this will shake out; at any rate, an upgrade to Borland C++ 3.0 is expected to account for the enhancements to Windows 3.1, including multimedia.

DRUMDLL.C contains four exported functions. Three of them—`DrumSetParams`, `DrumBeginSequence`, and `DrumEndSequence`—are defined in DRUMDLL.H and are called from the DRUM program. The other is the timer callback function, `DrumTimerFunc`.

The three functions called from the DRUM program are defined in DRUMDLL.H within a construction that looks like this:

```
extern "C"
{
    ...
}
```

PROGRAMMING ENVIRONMENTS

This is to prevent C++ from "name-mangling" these functions. C++ usually alters function names to include codes that indicate the parameter data types and return value, allowing for C++ function overloading and intermodule type checking during linking. Because different compilers perform name mangling in different ways, you'll probably want to avoid it for functions exported from dynamic link libraries for use by Windows programs. Otherwise you won't be able to use a dynamic link library from a program compiled with a compiler different from that used for the DLL. In DRUMDLL.C, I've also used the extern "C" statement for the MMSYSTEM.H header file, because the version I have is not C++-ready.

DRUMDLL also has a `LibMain` function. Such a function usually unlocks the DLL's data segment, but here it needn't do anything because the data segment is fixed. The only other function is `MidiOutMessage`, which simplifies the construction of MIDI messages in preparation for calling the Multimedia Windows function `midiOutShortMsg`.

I usually don't like to use global variables very much, but this DLL is made much simpler with them. Global vari-

ables in a DLL are shared among all programs that use the DLL, so only one program (or one instance of a program) can use DRUMDLL at any time. The DRUM program does not allow running a second instance, and I've used the `-p` flag when running the resource compiler in the DRUMDLL Make files so that other programs can't use DRUMDLL while DRUM is running.

THE WORKINGS OF DRUMDLL

The DRUM program calls the `DrumSetParams` function in DRUMDLL at various times: when DRUM's window is created, when the user clicks on the grid or manipulates the scroll bars, when the program loads a .DRM file from disk, or when the grid is cleared. The single parameter to `DrumSetParams` is a pointer to a structure of type `DRUM`, defined in DRUMDLL.H. This structure stores the beat time in milliseconds, the velocity, the number of beats in the sequence, and two sets of 32-bit integers (47 integers per set) for storing the grid settings for the base-level and extended synthesizers. Each bit in these 32-bit integers corresponds to a beat of the sequence.

The DRUM program maintains a structure of type `DRUM` in static memory and passes a pointer to it when calling `DrumSetParams`. `DrumSetParams` simply

DRUMDLL.MSC

COMPLETE LISTING

```
-----
# DRUMDLL.MSC make file for Microsoft C 7.0
-----

drumdll.dll : drumdll.obj drumdll.def
link drumdll, drumdll.dll, NUL, /nod edllcsw oldnames libw mmsystem, \
drumdll
rc -t -p drumdll.dll

drumdll.obj : drumdll.c drumdll.h
cl -c -ASW -G2sw -OW -W3 -Zp -Tp drumdll.c
```



Figure 3: This is the Make file for compiling under Microsoft C 7.0.

DRUMDLL.BCP

COMPLETE LISTING

```
-----
# DRUMDLL.BCP make file for Borland C++ 3.0
-----

drumdll.exe : drumdll.obj drumdll.def
tlink /c /n /Tw /Lc:\borlandc\lib c@ds drumdll, drumdll, NUL, \
import mathws cws mmsystem, drumdll
rc -t -p drumdll.dll

drumdll.obj : drumdll.c drumdll.h
bcc -c -ms! -w-par -P -W -2 drumdll.c
```



Figure 4: This is the Make file for compiling under Borland C++ 3.0.

copies the contents of the structure to static memory in the DLL. You might think that it would only be necessary for DRUMDLL to save a pointer to the DRUM structure located in DRUM, but this would violate one of the rules for using a timer callback function: Any data the timer callback function accesses must be in a fixed data segment.

To start the sequence, DRUM calls the DrumBeginSequence function in DRUMDLL. The only parameter is a

window handle. This is used for notification.

DrumBeginSequence opens the MIDI Mapper output device and, if successful, sends Program Change messages to select instrument voice 0 for MIDI channels 9 and 15. As you may recall from the last issue, channel 9 is the percussion channel for extended synthesizers, and channel 15 is the percussion channel for

base-level synthesizers. To use the percussion channel, you select voice 0. Different key numbers in the Note On messages then select different percussion sounds.

DrumBeginSequence continues by calling timeGetDevCaps and then timeBeginPeriod. The desired timer resolution defined in the TIMER_RES constant is 5 ms., but I've defined a macro called minmax to calculate a resolution within the limits returned from timeGetDevCaps.

DRUMDLL.C

COMPLETE LISTING

```

/*-----
DRUMDLL.C -- DLL module for DRUM program
(c) Charles Petzold, 1992
-----*/

#include <windows.h>
extern "C" {
#include <system.h>
}
#include <string.h>
#include "drumdll.h"

#define min(a,b) ((a) < (b)) ? (a) : (b)
#define max(a,b) ((a) > (b)) ? (a) : (b)
#define minmax(a,x,b) (min (max (x, a), b))

#define TIMER_RES 5

void FAR PASCAL _export DrumTimerFunc (WORD, WORD, DWORD, DWORD, DWORD);

BOOL bsequenceGoing, bEndSequence;
DRUM drum;
HMIDIOUT hMidiOut;
HWND hwndNotify;
int iIndex;
WORD wTimerRes, wTimerID;

int FAR PASCAL LibMain (HANDLE hInstance, WORD wDataSeg, WORD wHeapSize,
LPSTR lpzCmdLine)
{
return 1;
}

DWORD MidiOutMessage (HMIDIOUT hMidi, int iStatus, int iChannel,
int iData1, int iData2)
{
DWORD dwMessage;

dwMessage = iStatus | iChannel | (iData1 << 8) | ((long) iData2 << 16);
return midiOutShortMsg (hMidi, dwMessage);
}

void FAR PASCAL _export DrumSetParams (PDRUM pdrum)
{
memcpy (&drum, pdrum, sizeof (DRUM));
}

BOOL FAR PASCAL _export DrumBeginSequence (HWND hwnd)
{
TIMECAPS tc;

hwndNotify = hwnd; // Save window handle for notification
DrumEndSequence (TRUE); // Stop current sequence if running

// Open the MIDI Mapper output port
if (midiOutOpen (&hMidiOut, (WORD) MIDIMAPPER, NULL, NULL, 0L))
return FALSE;

// Send Program Change messages for channels 9 and 15
MidiOutMessage (hMidiOut, 0xC5, 9, 0, 0);
MidiOutMessage (hMidiOut, 0xC5, 15, 0, 0);

// Begin sequence by setting a timer event
timeGetDevCaps (&tc, sizeof (TIMECAPS));
wTimerRes = minmax (tc.wPeriodMin, TIMER_RES, tc.wPeriodMax);
timeBeginPeriod (wTimerRes);

wTimerID = timeSetEvent (max ((int) wTimerRes, drum.iMsecPerBeat),
wTimerRes, DrumTimerFunc, 0L, TIME_ONESHOT);

if (wTimerID == 0)
{
timeEndPeriod (wTimerRes);
midiOutClose (hMidiOut);
return FALSE;
}

iIndex = -1;
bEndSequence = FALSE;
bsequenceGoing = TRUE;

return TRUE;
}

void FAR PASCAL _export DrumEndSequence (BOOL bRightAway)
{
if (bRightAway)
{
if (bsequenceGoing)
{
// stop the timer
if (wTimerID)
timeKillEvent (wTimerID);
timeEndPeriod (wTimerRes);

// turn off all notes
MidiOutMessage (hMidiOut, 0x80, 9, 123, 0);
MidiOutMessage (hMidiOut, 0x80, 15, 123, 0);

// close the MIDI port
midiOutClose (hMidiOut);
bsequenceGoing = FALSE;
}
else
bEndSequence = TRUE;
}
}

void FAR PASCAL _export DrumTimerFunc (WORD wID, WORD wMsg, DWORD dwUser,
DWORD dw1, DWORD dw2)
{
static DWORD dwSeqExtLast [NUM_PERC], dwSeqBasLast [NUM_PERC];
int i;

// Note Off messages for channels 9 and 15
if (iIndex != -1)
for (i = 9; i < NUM_PERC; i++)
{
if (dwSeqExtLast[i] & 1L << iIndex)
MidiOutMessage (hMidiOut, 0x80, 9, i + 35, 0);

if (dwSeqBasLast[i] & 1L << iIndex)
MidiOutMessage (hMidiOut, 0x80, 15, i + 35, 0);
}

// Increment index and notify window to advance bouncing ball
iIndex = (iIndex + 1) & drum.iNumBeats;
PostMessage (hwndNotify, WM_USER_NOTIFY, iIndex, timeGetTime ());

// Check if ending the sequence
if (bEndSequence && iIndex == 0)
{
PostMessage (hwndNotify, WM_USER_FINISHED, 0, 0L);
return;
}

// Note On messages for channels 9 and 15
for (i = 9; i < NUM_PERC; i++)
{
if (drum.dwSeqExt[i] & 1L << iIndex)
MidiOutMessage (hMidiOut, 0x90, 9, i + 35, drum.iVelocity);

if (drum.dwSeqBas[i] & 1L << iIndex)
MidiOutMessage (hMidiOut, 0x90, 15, i + 35, drum.iVelocity);

dwSeqExtLast[i] = drum.dwSeqExt[i];
dwSeqBasLast[i] = drum.dwSeqBas[i];
}

// Set a new timer event
wTimerID = timeSetEvent (max ((int) wTimerRes, drum.iMsecPerBeat),
wTimerRes, DrumTimerFunc, 0L, TIME_ONESHOT);

if (wTimerID == 0)
{
PostMessage (hwndNotify, WM_USER_ERROR, 0, 0L);
}
}

```



Figure 5: Here is the source code for the DRUMDLL dynamic link library.



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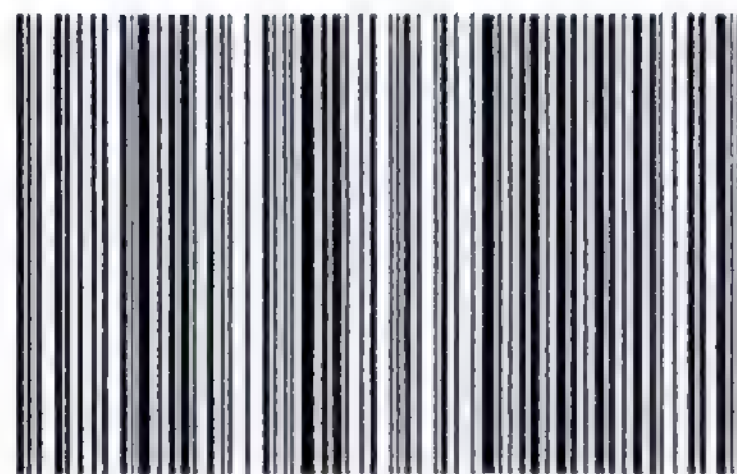
2. Arrow pointing to the fold

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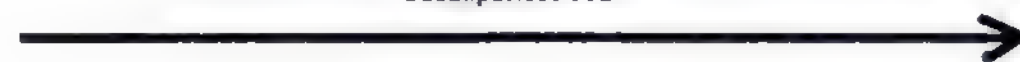
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Inverted Foldout slip-sheet



GbsSlipSheet-001



Foldout slip-sheet

1. Open the foldout page

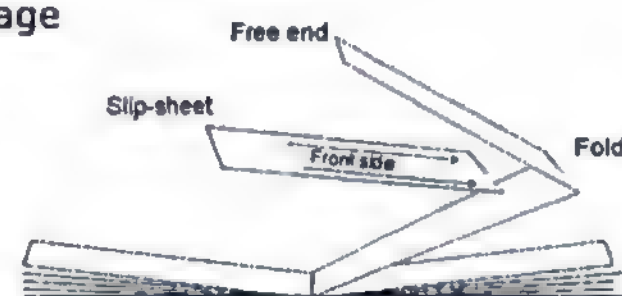
2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

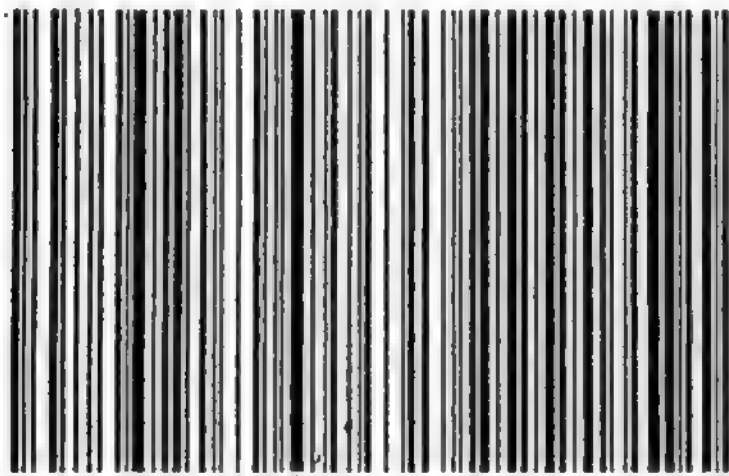
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4. Close the page and slip-sheet



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The next call is `timeSetEvent`, which specifies the beat time, the calculated resolution, the callback function `DrumTimerFunc`, and the constant `TIME_ONESHOT`. `DRUMDLL` uses a one-shot timer rather than a periodic timer so that the tempo can be dynamically changed while a sequence is running. After the `timeSetEvent` call, the timer device driver will call `DrumTimerFunc` when the delay time has elapsed.

PLAYING THE SEQUENCE

The `DrumTimerFunc` callback is the function where most of the heavy action takes place. The variable `iIndex` stores the current beat in the sequence. The callback begins by sending MIDI Note Off messages for the drum sounds currently playing. (`iIndex` has an initial value of -1 to prevent this when the sequence first begins.) Note Off messages are sent to channel 9 for extended synthesizers and channel 15 for base-level synthesizers.

Next, `iIndex` is incremented, and its value is delivered to the window procedure in `DRUM` with a user-defined message called `WM_USER_NOTIFY`. The `wParam` message parameter is set to `iIndex` so that `WndProc` in `DRUM.C` can move the "bouncing ball" at the bottom of the grid. The `lParam` parameter is set to the current system time obtained from `timeGetTime`. `WndProc` doesn't do anything with the system time, but I used it for de-

bugging purposes and left it in so I could claim that `DRUMDLL` illustrates all six essential multimedia timer functions!

`DrumTimerFunc` finishes by sending Note On messages to the synthesizer for channels 9 and 15, saving the grid values so the sounds can be turned off the next time through, and then setting a new one-shot timer event by calling `timeSetEvent`.

To stop the sequence, `DRUM` calls `DrumEndSequence` with a single parameter that can be set to either `TRUE` or `FALSE`. If it is `TRUE`, then `DrumEndSequence` ends the sequence right away by killing any pending timer event, calling `timeEndPeriod`, sending "all notes off" messages to the two MIDI channels, and closing the MIDI output port.

`DRUM` calls `DrumEndSequence` with a `TRUE` parameter when the user decides to terminate the program. If the user selects Stop from the Sequence menu in `DRUM`, however, the program instead calls `DrumEndSequence` with a `FALSE` parameter. This allows the sequence to complete the current cycle before ending. `DrumEndSequence` responds to this call by setting the `bEndSequence` global variable to `NULL`. If `bEndSequence` is `TRUE` and the beat index has been set to 0, `DrumTimerFunc` posts a user-defined message called `WM_USER_FINISHED` to `WndProc`. `WndProc` must respond to this message

by calling `DrumEndSequence` with a `TRUE` parameter to terminate the use of the timer and the MIDI port properly.

In an earlier version of the program, `DrumTimerFunc` itself called `DrumEndSequence` with a `TRUE` parameter to shut down. It seemed to work fine, but I realized that `DrumEndSequence` was calling functions not listed as those allowed within timer callbacks.

The lesson: Be careful when writing a timer callback function. Because you're coding in C, it's easy to forget that you're writing code that has to be executed during a hardware timer interrupt. Keep the list of allowable functions close at hand. It could well be that other functions can safely be called from a timer callback, but do you really want to take a chance that the next version of Windows will still work that way? Most C runtime functions should be okay, but don't try any file I/O during the timer callback.

If you need to perform a task based on the multimedia timer that you can't do without calling some other Windows function, use `PostMessage` to inform a window procedure of the timer event and let the window procedure do it. `PostMessage` is fine because all it does is place a message in a message queue. The window procedure retrieves the message later—not during the timer interrupt.

Keep in mind also that the hardware timer could interrupt code in your program or other code in the DLL. This might be a problem if you're altering data that the callback function accesses. I decided this would not be a problem in `DRUMDLL`, but if you have critical sections of your code that should not be interrupted by a timer interrupt, surround the code with calls to the `_disable` and `_enable` functions provided in both the Microsoft C and Borland C++ runtime libraries.

FINISHING UP

We're not finished with `DRUM` just yet. The `DRUM` program can also save and retrieve files containing the information stored in the `DRUM` structure. These files are in the Resource Interchange File Format (RIFF) recommended for multimedia file types. You can read and write RIFF files using standard file I/O functions, of course, but an easier approach is provided by functions beginning with the prefix `mmio` (multimedia input/output). In the next issue, I'll discuss these functions and the new "common dialog box" library included in Windows 3.1.

DRUMDLL.H

COMPLETE LISTING

```
/*-----
DRUMDLL.H header file for DLL module for DRUM program
-----*/

#define NUM_PERC          47
#define WM_USER_NOTIFY    (WM_USER + 1)
#define WM_USER_FINISHED (WM_USER + 2)
#define WM_USER_ERROR     (WM_USER + 3)

typedef struct
{
    int    iMsecPerBeat ;
    int    iVelocity ;
    int    iNumBeats ;
    DWORD  dwSeqBas [NUM_PERC] ;
    DWORD  dwSeqExt [NUM_PERC] ;
}
DRUM ;

typedef DRUM FAR *PDRUM ;

extern "C"
{
    void FAR PASCAL _export DrumSetParams      (PDRUM) ;
    BOOL FAR PASCAL _export DrumBeginSequence (HWND) ;
    void FAR PASCAL _export DrumEndSequence   (BOOL) ;
}
```



Figure 6: This header file for the dynamic link library is also used by `DRUM.C`.

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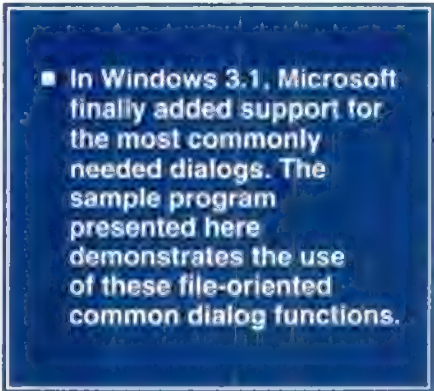
Power Programming

The Windows File-Oriented Common Dialog Functions

One of the more interesting aspects of the headlong rush to Microsoft Windows among DOS developers and users is the way it has focused attention on the Macintosh as both the champion and the villain of the graphical user interface (GUI). DOS users who resist Windows are quick to characterize it as "nothing but pretty pictures," "good only for playing solitaire," and "wimpy like the Mac," while those who embrace the GUI can be heard claiming that "Windows makes the PC just as good as the Mac, so there's no longer any reason to buy a Mac." IBM has been unmasked as suffering from a severe case of Mac envy, and has recently formed an alliance with Apple for the joint development of operating systems; the long-range implications of that alliance are anything but clear. Even Apple has done its part to validate the supposed threat of Windows and stir up further confusion, as witness its totally outrageous "look and feel" lawsuit against Microsoft.

I've used both the Mac and Windows on a daily basis for several years, and the claims, counterclaims, and lawsuit seem a bit silly to me. Windows is like the Mac in some ways: It runs in graphics mode, and its applications perform their output in bordered, resizable regions of the screen. Beyond that, however, the resemblance is not all that impressive. The Macintosh's 32-bit operating system was built from the ground up expressly for a graphical user interface; its routines for handling the screen and mouse lie at the very foundation of the system and are highly optimized.

The Windows graphical user interface, on the other hand, is layered on top of a fundamentally text mode-oriented 16-bit operating system whose lineage can be traced directly back to CP/M, and beyond that to Digital Equipment Corp.'s minicomputer operating systems designed for 10 character-per-second teletypes. The Macintosh desktop was designed by graphics and user-interface experts, while the



■ In Windows 3.1, Microsoft finally added support for the most commonly needed dialogs. The sample program presented here demonstrates the use of these file-oriented common dialog functions.

Windows desktop appears to have just happened. For example, the senseless division of function between the Windows Program Manager and File Manager is in stark contrast to the elegance of the Macintosh's Finder. The same comparisons between the Macintosh and Windows can be made at the application program interface (API) level, although it would be heartless to go into the details in this column.

A telling example of the slapdash evolution of Windows compared with the Macintosh can be found in the dialogs for the fundamental user interactions: opening a file, saving a file under a new name, setting up the printer, choosing a font or color, and so on. These dialogs, which are required by virtually every application, are paradoxically some of the most difficult and complex to implement in Windows.

In the Macintosh, these dialogs have been built into the operating system from the earliest days, yielding a more uniform user interface across applications and re-

quiring less work from application programmers.

In Windows, the implementation of these dialogs has been left as an exercise for third-party software developers, with predictable results: The File Open or File Save As dialog of nearly every application is different, the learning curve for end users is lengthened, and the programmers' time and energy are diverted from the core logic of their applications to tasks that should actually be handled at the system level.

In Windows 3.1, Microsoft has finally seen fit to add support for the most commonly needed dialogs, as shown in Figure 1. We'll talk about the file-oriented common dialogs in detail in this installment, and we'll continue our discussion by looking at the remainder of the dialogs in the next two issues.

THE COMMON FILE DIALOGS

From the developer's point of view, there are three vital components to the common dialogs:

■ **COMMDDL.DLL**: This is the dynamic link library (DLL) containing the common dialog routines and resources. This DLL is included with Windows 3.1, but it does not require Windows 3.1 to operate. Microsoft licenses third-party developers to ship COMMDDL.DLL with their applications, so those applications that use the common dialogs can also run under Windows 3.0.

■ **COMMDDL.H**: This is the common dialog header file, which holds the function prototypes for the common dialog routines as well as the definitions of the

THE WINDOWS 3.1 COMMON DIALOGS		
Dialog name	COMMDLG entry point name	Description
Open	GetOpenFileName()	Displays a list of filenames matching any specified extensions, directories, and drives. The filename selected by the user is returned to the application.
Save As	GetSaveFileName()	Displays a list of filenames matching any specified extensions, directories, and drives. The filename selected by the user is returned to the application.
Color	ChooseColor()	Displays the available colors and allows the user to define a custom color.
Font	ChooseFont()	Displays a list of typefaces, point sizes, styles, and colors that correspond to the available fonts. When the user selects a font, the dialog displays some sample text in that font.
Print	PrintDlg()	Displays information about the currently selected printer and its configuration, allows the user to specify how the output should be printed, and starts the printing process.
Find	FindText()	Allows the user to enter a string that will be used as the target in an application's search operation. The user can specify the direction of the search and whether the search should be case-sensitive.
Replace	ReplaceText()	Allows the user to enter two strings: one that will be the search target and one that will be the replacement.

Figure 1: The code and resources for these dialogs are implemented in the dynamic link library COMMDLG.DLL supplied by Microsoft.

data structures those routines use. You must include this header file at the beginning of any C module that will use the common dialog functions.

■ **COMMDLG.LIB:** This is the import library for the common dialog routines in COMMDLG.DLL. If you use common dialogs in your program, you must link your program against this library so that the necessary information for dynamic linking with COMMDLG.DLL will be built into your program's .EXE file.

Microsoft also includes foreign-language versions of COMMDLG.DLL in the Windows 3.1 Software Development Kit (SDK):

COMMDLG.SWE	Swedish
COMMDLG.SPA	Spanish
COMMDLG.POR	Portuguese
COMMDLG.NOR	Norwegian
COMMDLG.ITA	Italian
COMMDLG.GER	German
COMMDLG.FRA	French
COMMDLG.FIN	Finnish
COMMDLG.DUT	Dutch
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OPENFILENAME'S FIELDS

Field name	Description
lStructSize	Specifies the length of the structure in bytes (used as a sanity check by Windows).
hwndOwner	The handle for the window that owns the dialog box. Can be 0 if the OFN_SHOWHELP bit is not set in the Flags field.
hInstance	The handle for a data block that contains a dialog box template. Ignored if the OFN_ENABLETEMPLATE or OFN_ENABLETEMPLATEHANDLE bit is not set in the Flags field.
lpstrFilter	A far pointer to a buffer containing a series of filter string pairs. The first string of a pair is a description (for instance, "Text Files"), and the second is the filter pattern (such as "*.TXT"). The pointer can be NULL.
lpstrCustomFilter	Points to a buffer that receives a filter pattern entered by the user. Can be NULL.
nMaxCustFilter	The length of the buffer pointed to by lpstrCustomFilter. Ignored if lpstrCustomFilter is NULL.
nFilterIndex	The 1-based index to the sets of filter strings pointed to by lpstrFilter; specifies the filter initial used and displayed by the dialog box.
lpstrFile	Points to a buffer that contains an initializing string for the filename edit control (can be a null string). The same buffer receives the fully qualified filename selected by the user within the dialog.
nMaxFile	The size of the buffer pointed to by lpstrFile.
lpstrFileName	Points to a buffer that receives the filename and extension of the file selected by the user (the drive and path are stripped off). Can be NULL.
nMaxFileName	The size of the buffer pointed to by lpstrFileName. Ignored if lpstrFileName is NULL.
lpstrInitialDir	Points to a string specifying the initial directory to be displayed by the dialog. Can be NULL, in which case the "current directory" is used.
lpstrTitle	Points to a string to be displayed in the title bar of the dialog. Can be NULL, in which case "Open" or "Save As" is displayed in the title bar, as appropriate.
Flags	The dialog box initialization flags. See Figure 3.
nFileOffset	Receives the 0-based offset to the beginning of the filename in the buffer pointed to by lpstrFile.
nFileExtension	Receives the 0-based offset to the beginning of the extension in the buffer pointed to by lpstrFile.
lpstrDefExt	Points to a string specifying the default extension to be added to the filename if the user does not enter an extension. Can be NULL.
lCustData	Specifies application-defined data to be passed to the function pointed to by the lpfnHook field.
lpfnHook	The address of the application's "hook" function for the dialog. Ignored if the OFN_ENABLEHOOK bit is not set in the Flags field.
lpTemplateName	Points to a string that specifies the name of the resource file for a custom dialog template. Ignored if the OFN_ENABLETEMPLATE bit is not set in the Flags field.

Figure 2: These are the fields of the OPENFILENAME structure used by the common dialog functions GetOpenFileName() and GetSaveFileName().

gram for sale in Europe, you can simply pick the appropriate foreign-language common dialog file from the list above, rename it COMMDLG.DLL, and ship it with your application.

The two routines in COMMDLG.DLL that invoke the file-oriented common dialogs are called GetOpenFileName() and GetSaveFileName(). The calling sequences

for these routines are very simple: Each accepts a far pointer to an OPENFILENAME structure and returns a Boolean flag. The flag is TRUE if the user selects or enters a valid filename and clicks the OK button; it is FALSE if an error occurs, if the filename is not valid, or if the user clicks the Cancel button. For example,

```
OPENFILENAME ofn;
BOOL status;

.
.
.
status = GetOpenFileName(&ofn);

if(status)
{
    _lopen(....)
}
}
```

While the calling sequence for both the GetOpenFileName() and GetSaveFileName() routines may be straightforward, using the OPENFILENAME structure is not. The structure contains many fields; some are used by the application to pass parameters to COMMDLG.DLL, some are used to return results, and some contain pointers to other buffers that are used to pass information in one or both directions. As Figures 2 and 3 illustrate, the different combinations in which the application can initialize the fields give the file common dialog functions an enormous amount of flexibility. Fortunately, when an application simply wants to get a filename from the user without any fancy tricks, most of the fields of the structure can be either initialized to a NULL pointer or ignored altogether. For example,

```
OPENFILENAME ofn;
BOOL status;

.
.
.
ofn.lStructSize =
sizeof(OPENFILENAME);
ofn.hwndOwner = hwnd;
ofn.lpstrFilter = szFilter[0];
ofn.lpstrCustomFilter = NULL;
ofn.nFilterIndex = 1;
ofn.lpstrFile = szFileName;
ofn.nMaxFile = EXENAMESIZE;
ofn.lpstrFileName = NULL;
ofn.lpstrInitialDir = NULL;
ofn.lpstrTitle = NULL;
ofn.Flags = OFN_PATHMUSTEXIST |
OFN_FILEMUSTEXIST;
ofn.lpstrDefExt = NULL;
szFileName[0] = '\0';

.
.
.
status = GetOpenFileName(&ofn);
```


PC MAGAZINE OPENFILENAME'S FLAGS FIELD	
Flag name	Significance
OFN_ALLOWMULTISELECT	Specifies that the filename list box should allow multiple selections.
OFN_CREATEPROMPT	Specifies that when the selected file does not exist, the user is asked whether it should be created.
OFN_ENABLEHOOK	Enables the hook function pointed to by the lpfnHook field.
OFN_ENABLETEMPLATE	Causes the system to use the custom dialog box template identified by the hInstance and lpTemplateName fields.
OFN_ENABLETEMPLATEHANDLE	Causes the system to use the custom dialog box template identified by the hInstance field.
OFN_EXTENSIONDIFFERENT	Specifies that the returned extension is different from the one specified by the lpstrDefExt field.
OFN_FILEMUSTEXIST	Specifies that the user is only allowed to select a file that already exists.
OFN_HIDEREADONLY	Specifies that the Read-Only checkbox of the dialog should be hidden.
OFN_NOCHANGEDIR	Forces the dialog box to reset the current directory to what it was when the dialog was created.
OFN_NOREADONLYRETURN	Specifies that the file selected by the user may not be read-only or located in a read-only directory.
OFN_NOTESTFILECREATE	Specifies that the file will not be created prior to return from the dialog.
OFN_NOVALIDATE	Specifies that the dialog will allow invalid characters in the filename entered by the user.
OFN_OVERWRITEPROMPT	Causes the Save As dialog to ask the user whether an existing file should be overwritten.
OFN_PATHMUSTEXIST	Specifies that the user may not enter a path that does not exist.
OFN_READONLY	Causes the Read-Only checkbox to be initially checked when the dialog box is displayed.
OFN_SHAREAWARE	Specifies that sharing conflicts should be ignored.
OFN_SHOWHELP	Causes the dialog box to display a Help push button. The calling program must provide a hook function that can service the message generated by the button and invoke the Windows Help engine or display other help.

Figure 3: These are the bit flags in the OPENFILENAME.Flags field.

Ordinarily, the appearance of the two file-oriented common dialogs is the same regardless of the identity of the calling application, as shown in Figure 4. Similarly, the internal operation of `GetOpenFileName()` or `GetSaveFileName()` is a "black box." If an application calls one of these functions, it has no way of seeing the creation of the dialog box; the handling of the various buttons, list boxes, and edit fields within the dialog box; the user's navigation through the directory structure and selection or entry of a filename; and the destruction of the dialog box. The application regains control only after the user has either designated a file

and clicked the OK button or clicked the Cancel button and the dialog box has disappeared from the screen. This is as it should be; relieving the application of having to concern itself with those functions is the major reason for having common dialogs in the first place.

For those specialized application programs that need to extend the common dialog's controls or to monitor their operation more closely, the operation of the two file-oriented common dialogs may be customized in two ways. First, the application can specify a "hook" function that receives special messages while either `GetOpenFileName()` or `GetSaveFile-`

`Name()` is executing. These messages are sent when the user either makes a selection in a single-selection list box, adds to or subtracts from the selection in a multiple-item list box, or selects a filename and clicks the OK button. The application can act upon these messages to influence the user's activities in the dialog box before the box is closed.

Second, the application can alter the appearance of the common dialog boxes by specifying a hook function and a special dialog template. The hook function receives all of the messages from the dialog box before the usual callback function that is buried in `COMMDLG.DLL` does, and it must process all messages from controls that are not part of the standard dialog template.

If you're an experienced Windows developer, you may be reluctant to modify your existing applications by junking all that code you've carefully built up for File Open and File Save As dialog boxes and adding new code to support the Microsoft common dialogs. After all, why fix it if it ain't broke? But there are good reasons to invest the necessary time and put up with the inevitable aggravation now. The most important is that employing common dialogs helps standardize the user interface, and if users have to spend less time figuring out new applications, they'll have a greater tendency to use more programs—an obvious boon for Windows developers.

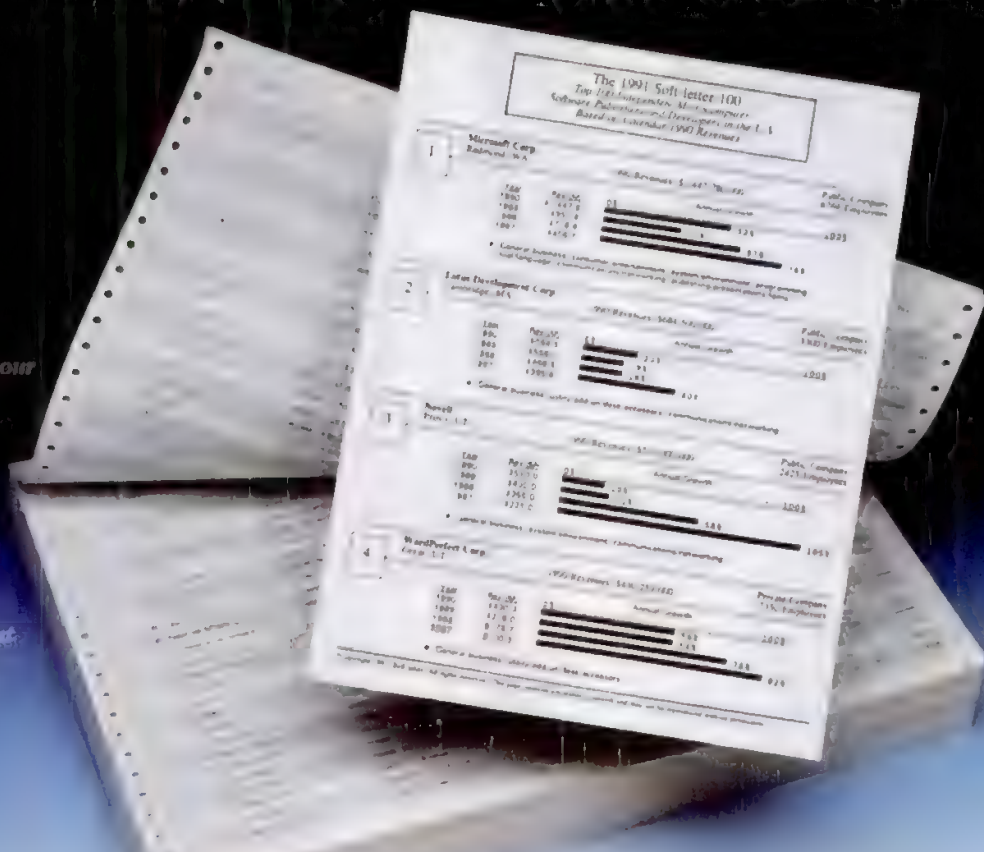
Another good reason is that the code and resource templates for the common dialogs reside in a DLL that can be shared by all applications, which tends to reduce each application's .EXE size and start-up time. A third consideration is that when Microsoft improves the common dialogs, or enhances them to take advantage of future file systems, all applications that use the common dialogs will benefit automatically. Similarly, porting such applications to the DOS or NT version of WIN32, which also offers the common-dialog API, will be facilitated. Finally, adapting a program for international release using the common dialogs becomes much easier, because much of the work of modifying applications for different locales is shifted to Microsoft.

THE DLGDEMO PROGRAM

In order to demonstrate use of the file common dialog functions, I've written `DLGDEMO`, a small clone of the Windows Notepad program. The source code

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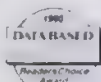
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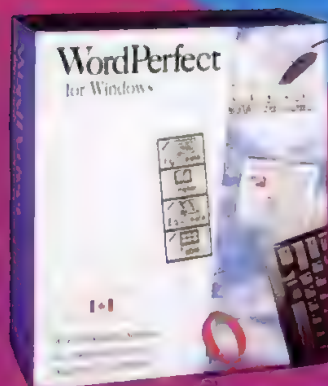
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3

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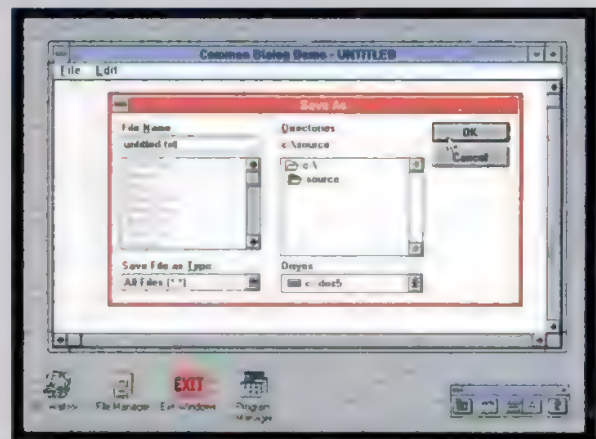
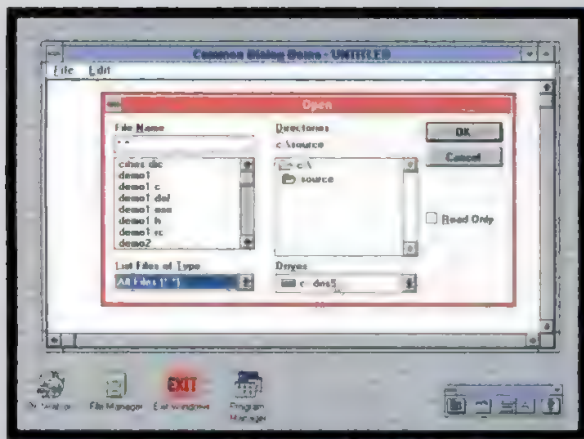


Figure 4: As you can see, the appearance of the File Open common dialog (left) and the File Save As common dialog (right) is usually the same regardless of the calling application.

for DLGDEMO can be found in Figure 5. For reasons of space, we have not included here DLGDEMO.H, which is the C-language header file; DLGDEMO.DEF, the module definition file that defines the stack and heap size, segment characteris-

tics, and other information used by the linker; and DLGDEMO.RC, the resource script that defines DLGDEMO's menu bar. The resource script is processed by the Resource Compiler and merged into the .EXE file produced by the linker to

form the final Windows executable program. All of these files can be downloaded from PC MagNet.

Clones of the Notepad are not exactly a novel idea. In fact, Notepad clones are found in the Microsoft Windows SDK,

DLGDEMO.C
1 OF 3

```
//
// DLGDEMO - Notepad clone demonstrating use of Win 3.1 Common Dialogs
// Copyright (C) 1992 Ray Duncan
// Siff Davis Publishing Co. • PC Magazine
//

#define WIN31
#define dim(x) (sizeof(x) / sizeof(x[0])) // returns no. of elements
#define EXEHNAME 256 // max length of path+filename
#define BUFSIZE 65520 // max length of file data

#include "string.h"
#include "windows.h"
#include "comdlg.h"
#include "dlgdemo.h"

HANDLE hInst; // module instance handle
HWND hFrame; // handle for frame window
HWND hEdit; // handle for edit window
char szFileName[EXEHNAME+1]; // name of current file
char szTemp[EXEHNAME+1]; // filename scratch buffer
int hFile; // handle for current file
HANDLE hBuff; // handle for file I/O buffer
LPSTR lpBuff; // far pointer to file buffer

char szShortAppName[] = "DlgDemo"; // short application name
char szAppName[] = "Common Dialog Demo"; // long application name
char szMenuName[] = "DlgDemoMenu"; // name of menu resource
char szDefName[] = "UNTITLED"; // default filename
char szDefExt[] = ".TXT"; // default extension

char *szFilter[] = { // filters for Open and SaveAs common dialogs
    "ASCII Text (*.TXT)", "*.TXT",
    "All Files (*.*)", "*.*",
    ""
};

struct decodeWord { // structure associates
    WORD code; // messages or menu IDs
    LONG (*Fxn)(HWND, WORD, WORD, LONG); // with a function
};

// Table of window messages supported by FrameWndProc()
// and the functions which correspond to each message.
//
struct decodeWord messages[] = {
    WM_CREATE, DoCreate,
    WM_INITMENU, DoInitMenu,
    WM_SETFOCUS, DoSetFocus,
```

```
WM_SIZE, DoSize,
WM_COMMAND, DoCommand,
WM_DESTROY, DoDestroy, } ;

// Table of menu item IDs and their corresponding functions.
//
struct decodeWord menuItems[] = {
    IDM_NEW, DoMenuNew,
    IDM_OPEN, DoMenuOpen,
    IDM_SAVE, DoMenuSave,
    IDM_SAVEAS, DoMenuSaveAs,
    IDM_EXIT, DoMenuExit,
    IDM_UNDO, DoMenuUndo,
    IDM_CUT, DoMenuCut,
    IDM_COPY, DoMenuCopy,
    IDM_PASTE, DoMenuPaste,
    IDM_DELETE, DoMenuDelete, } ;

// WinMain -- entry point for this application from Windows.
//
int PASCAL WinMain(HANDLE hInstance,
    HANDLE hPrevInstance, LPSTR lpCmdLine, int nCmdShow)
{
    MSG msg;

    hInst = hInstance; // save this instance handle

    if(!hPrevInstance) // if first instance,
        if(!InitApplication(hInstance)) // register window class
            return(FALSE); // exit if couldn't register

    if(!InitInstance(hInstance, nCmdShow)) // create this instance's window
        return(FALSE); // exit if create failed

    while(GetMessage(&msg, NULL, 0, 0)) // while message != WM_QUIT
    {
        TranslateMessage(&msg); // translate virtual key codes
        DispatchMessage(&msg); // dispatch message to window
    }

    TerminateInstance(hInstance); // clean up for this instance
    return(msg.wParam); // return code = WM_QUIT value
}

//
```

Figure 5: Here is the source code for the sample program DLGDEMO.

```
// InitApplication --- global initialization code for this application.
//
BOOL InitApplication(HANDLE hInstance)
{
    WNDCLASS wc;

    // set parameters for frame window class
    wc.style = CS_HREDRAW|CS_VREDRAW; // class style
    wc.lpfnWndProc = FrameWndProc; // class callback function
    wc.cbClsExtra = 0; // extra per-class data
    wc.cbWndExtra = 0; // extra per-window data
    wc.hInstance = hInstance; // handle of class owner
    wc.hIcon = LoadIcon(NULL, IDI_APPLICATION); // default icon
    wc.hCursor = LoadCursor(NULL, IDC_ARROW); // default cursor
    wc.hbrBackground = GetStockObject(WHITE_BRUSH); // background color
    wc.lpszMenuName = szMenuName; // name of menu resource
    wc.lpszClassName = szShortAppName; // name of window class

    return(RegisterClass(&wc)); // register class, return status
}

//
// InitInstance --- instance initialization code for this application.
//
BOOL InitInstance(HANDLE hInstance, WORD nCmdShow)
{
    hFrame = CreateWindow( // create frame window
        szShortAppName, // window class name
        szAppName, // text for title bar
        WS_OVERLAPPEDWINDOW, // window style
        CW_USEDEFAULT, CW_USEDEFAULT, // default position
        CW_USEDEFAULT, CW_USEDEFAULT, // default size
        NULL, // no parent window
        NULL, // use class default menu
        hInstance, // window owner
        NULL); // unused pointer

    if(!hFrame) return(FALSE); // error, can't create window

    hBuff = GlobalAlloc(GMEM_MOVEABLE, BUFSIZE); // allocate memory
    if(!hBuff) // abort if no memory
    {
        MessageBox(hFrame, "Can't allocate memory!", szAppName,
            MB_ICONSTOP|MB_OK);
        return(0);
    }

    lpBuff = GlobalLock(hBuff); // get far pointer to memory

    ShowWindow(hFrame, nCmdShow); // make frame window visible
    UpdateWindow(hFrame); // force WM_PAINT message
    SendMessage(hFrame, WM_COMMAND, // force new (empty) file by
        IDM_NEW, 0L); // simulating File-New command
    return(TRUE); // return success flag
}

//
// TerminateInstance --- instance termination code for this application.
//
BOOL TerminateInstance(HANDLE hInstance)
{
    GlobalUnlock(hBuff); // unlock the memory buffer
    GlobalFree(hBuff); // release the buffer
    return(TRUE); // return success flag
}

//
// FrameWndProc --- callback function for application frame window.
//
LONG FAR PASCAL FrameWndProc(HWND hwnd, WORD wMsg, WORD wParam, LONG lParam)
{
    int i; // scratch variable

    for(i = 0; i < dim(messages); i++) // decode window message and
    { // run corresponding function
        if(wMsg == messages[i].Code)
            return((*messages[i].Fxn)(hwnd, wMsg, wParam, lParam));
    }

    return(DefWindowProc(hwnd, wMsg, wParam, lParam));
}

//
// DoCreate --- process WM_CREATE message for frame window by
// creating a multiline edit control that will fill the frame window.
//
LONG DoCreate(HWND hwnd, WORD wMsg, WORD wParam, LONG lParam)
{
    hEdit = CreateWindow("edit", // class name
        NULL, // text for title bar
        WS_CHILD|WS_VISIBLE|WS_HSCROLL|
        WS_VSCROLL|WS_BORDER|ES_LEFT|ES_MULTILINE|
        ES_AUTOHSCROLL|ES_AUTOVSCROLL, // window style
        0, 0, // window position
        0, 0, // window size
        hwnd, // parent window
        IDE_MLE, // edit control ID
        hInst, // window owner
        NULL); // unused pointer

    return(0);
}

//
// DoSetFocus --- process WM_SETFOCUS message for frame window.
//
LONG DoSetFocus(HWND hwnd, WORD wMsg, WORD wParam, LONG lParam)
{
    SetFocus(hEdit); // toss the focus to
```

```
return(0); // multiline edit control
}

//
// DoSize --- process WM_SIZE message for frame window by resizing
// the multiline edit control to completely fill the client area.
//
LONG DoSize(HWND hwnd, WORD wMsg, WORD wParam, LONG lParam)
{
    MoveWindow(hEdit, 0, 0, LOWORD(lParam), HIWORD(lParam), TRUE);
    return(0);
}

//
// DoCommand --- process WM_COMMAND message for frame window by
// decoding the menu bar item with the menuitems[] array, then
// running the corresponding function to process the command.
//
LONG DoCommand(HWND hwnd, WORD wMsg, WORD wParam, LONG lParam)
{
    int i; // scratch variable

    if((wParam == IDM_MLE) && (HIWORD(lParam) == SN_ERRSPACE))
    {
        MessageBox(hwnd, "Out of memory!", "Common Dialog Demo",
            MB_OK | MB_ICONSTOP);
        return(0);
    }

    for(i = 0; i < dim(menuitems); i++) // decode menu command and
    { // run corresponding function
        if(wParam == menuitems[i].Code)
            return((*menuitems[i].Fxn)(hwnd, wMsg, wParam, lParam));
    }

    return(DefWindowProc(hwnd, wMsg, wParam, lParam));
}

//
// DoDestroy --- process WM_DESTROY message for frame window.
//
LONG DoDestroy(HWND hwnd, WORD wMsg, WORD wParam, LONG lParam)
{
    PostQuitMessage(0); // force WM_QUIT message to
    return(0); // terminate the event loop
}

//
// DoInitMenu --- initialize the items on menu bar according to the
// state of the multiline edit control. If nothing is selected, the
// edit-cut/copy/delete items are grayed out. If nothing has
// been changed since the last file read or write, the file-save item
// is grayed out. If no text is in the clipboard, the edit-paste
// item is grayed out.
//
LONG DoInitMenu(HWND hwnd, WORD wMsg, WORD wParam, LONG lParam)
{
    LONG selection;

    selection = SendMessage(hEdit, EM_GETSEL, 0, 0);

    if(HIWORD(selection) != LOWORD(selection)) // set cut/copy/
    { // delete status
        EnableMenuItem(wParam, IDM_CUT, MF_ENABLED);
        EnableMenuItem(wParam, IDM_COPY, MF_ENABLED);
        EnableMenuItem(wParam, IDM_DELETE, MF_ENABLED);
    }
    else
    {
        EnableMenuItem(wParam, IDM_CUT, MF_GRAYED);
        EnableMenuItem(wParam, IDM_COPY, MF_GRAYED);
        EnableMenuItem(wParam, IDM_DELETE, MF_GRAYED);
    }

    if(SendMessage(hEdit, EM_CANUNDO, 0, 0)) // set undo status
        EnableMenuItem(wParam, IDM_UNDO, MF_ENABLED);
    else
        EnableMenuItem(wParam, IDM_UNDO, MF_GRAYED);

    if(IsClipboardFormatAvailable(CF_TEXT)) // set paste status
        EnableMenuItem(wParam, IDM_PASTE, MF_ENABLED);
    else
        EnableMenuItem(wParam, IDM_PASTE, MF_GRAYED);

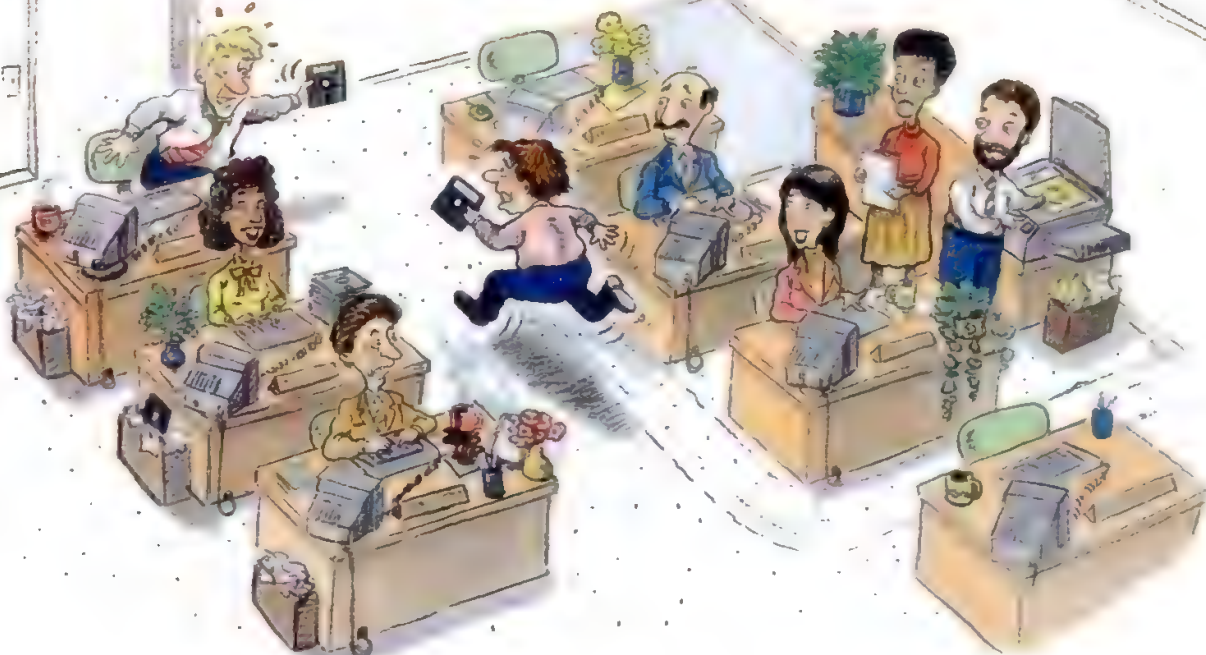
    if(SendMessage(hEdit, EM_GETMODIFY, 0, 0)) // set save status
        EnableMenuItem(wParam, IDM_SAVE, MF_ENABLED);
    else
        EnableMenuItem(wParam, IDM_SAVE, MF_GRAYED);

    return(0);
}

//
// DoMenuNew --- process File-New command from menu bar.
//
LONG DoMenuNew(HWND hwnd, WORD wMsg, WORD wParam, LONG lParam)
{
    QueryWriteFile(hEdit); // check for dirty buffer
    NewFile(hEdit); // empty the text window
    return(0);
}

//
// DoMenuOpen --- process File-Open command from menu bar.
//
```


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```

LONG DoMenuOpen(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    OPENFILENAME ofn;           // used by common dialogs
    QueryWriteFile(hEdit);      // check for dirty buffer
    szTemp[0] = '\0';          // init filename buffer

    ofn.lStructSize = sizeof(OPENFILENAME); // length of structure
    ofn.hwndOwner = hwnd;       // handle for owner window
    ofn.lpstrFilter = szFilter[0]; // address of filter list
    ofn.lpstrCustomFilter = NULL; // custom filter buffer address
    ofn.nFilterIndex = 1;       // use *.TXT filter
    ofn.lpstrFile = szTemp;      // buffer for path+filename
    ofn.nMaxFile = EXEMANESIZE; // length of buffer
    ofn.lpstrFileTitle = NULL;   // buffer for filename only
    ofn.lpstrInitialDir = NULL;  // initial directory for dialog
    ofn.lpstrTitle = NULL;       // title for dialog box
    ofn.Flags = OFN_PATHMUSTEXIST | OFN_FILEMUSTEXIST;
    ofn.lpstrDefExt = NULL;      // default extension

    if(GetOpenFileName(&ofn))    // display open dialog,
        ReadFile(hEdit);        // read data from file

    return(0);
}

//
// DoMenuSave -- Process File-Save command from menu bar. If
// filename is default (UNTITLED), ask user for a different one.
//
LONG DoMenuSave(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    int hFile;                  // scratch file handle

    if(strcmp(szFileName, szDefName) == 0) // if default name, use SaveAs
        SendMessage(hwnd, WM_COMMAND, IDM_SAVEAS, 0);
    else
        WriteFile(hEdit);       // otherwise write data to file

    return(0);
}

//
// DoMenuSaveAs -- process File-SaveAs command from menu bar.
//
LONG DoMenuSaveAs(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    OPENFILENAME ofn;           // used by common dialogs

    strcpy(szTemp, szFileName); // get default filename

    ofn.lStructSize = sizeof(OPENFILENAME); // length of structure
    ofn.hwndOwner = hwnd;       // handle of owner window
    ofn.lpstrFilter = szFilter[0]; // address of filter list
    ofn.lpstrCustomFilter = NULL; // custom filter buffer address
    ofn.nFilterIndex = 1;       // use *.TXT filter
    ofn.lpstrFile = szTemp;      // buffer for path+filename
    ofn.nMaxFile = EXEMANESIZE; // size of buffer
    ofn.lpstrFileTitle = NULL;   // buffer for filename only
    ofn.lpstrInitialDir = NULL;  // initial directory for dialog
    ofn.lpstrTitle = NULL;       // title for dialog box
    ofn.Flags = OFN_PATHMUSTEXIST | OFN_HIDEREADONLY | OFN_NOTESTFILECREATE;
    ofn.lpstrDefExt = szDefExt;  // default extension

    if(GetSaveFileName(&ofn))    // display save-as dialog,
        WriteFile(hEdit);       // write data to file

    return(0);
}

//
// DoMenuExit -- process File-Exit command from menu bar.
//
LONG DoMenuExit(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    QueryWriteFile(hEdit);      // check for dirty buffer
    SendMessage(hwnd, WM_CLOSE, 0, 0); // send window close message
    return(0);                  // to shut down the app
}

//
// DoMenuUndo -- process Edit-Undo command from menu bar.
//
LONG DoMenuUndo(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    SendMessage(hEdit, WM_UNDO, 0, 0); // tell the edit control
    return(0);
}

//
// DoMenuCut -- process Edit-Cut command from menu bar.
//
LONG DoMenuCut(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    SendMessage(hEdit, WM_CUT, 0, 0); // tell the edit control
    return(0);
}

//
// DoMenuCopy -- process Edit-Copy command from menu bar.
//
LONG DoMenuCopy(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    SendMessage(hEdit, WM_COPY, 0, 0); // tell the edit control
    return(0);
}

//
// DoMenuPaste -- process Edit-Paste command from menu bar.
//
LONG DoMenuPaste(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    SendMessage(hEdit, WM_PASTE, 0, 0); // tell the edit control
    return(0);
}

//
// DoMenuDelete -- process Edit-Delete command from menu bar.
//
LONG DoMenuDelete(HWND hwnd, WORD wmsg, WORD wParam, LONG lParam)
{
    SendMessage(hEdit, WM_CLEAR, 0, 0); // tell the edit control
    return(0);
}

//
// NewFile -- set empty text window with default filename.
//
VOID NewFile(HANDLE hEdit)
{
    lpBuff[0] = '\0';           // empty the edit control
    SetWindowText(hEdit, lpBuff); // put text into window
    strcpy(szFileName, szDefName); // set default filename
    SetWindowCaption(szFileName); // update title bar
    SendMessage(hEdit, EM_SETMODIFY, 0, 0); // clear change flag
}

//
// ReadFile -- read text from specified file to window, close file.
//
VOID ReadFile(HANDLE hEdit)
{
    int length;                 // scratch variable
    int hFile;                  // scratch file handle

    hFile = _lopen(szTemp, OF_READ); // try and open the file
    if(hFile == -1)              // bail out if no such file
    {
        MessageBox(hwnd, "Can't open file!", szAppName, MB_ICONSTOP|MB_OK);
        return;
    }

    strcpy(szFileName, szTemp); // save new filename
    length = _lread(hFile, lpBuff, BUFSIZE); // read the file
    lpBuff[length] = '\0';       // make text ASCII
    SetWindowText(hEdit, lpBuff); // put text into window
    _lclose(hFile);              // close the file
    SetWindowCaption(szFileName); // update title bar
    SendMessage(hEdit, EM_SETMODIFY, 0, 0); // clear change flag
}

//
// WriteFile -- write text from specified window to file, close file.
//
VOID WriteFile(HANDLE hEdit)
{
    int length;                 // scratch variable
    int hFile;                  // scratch file handle

    hFile = _lcreat(szTemp, 0); // try and create the file
    if(hFile == -1)              // bail out if create failed
    {
        MessageBox(hwnd, "Can't create file!", szAppName, MB_ICONSTOP|MB_OK);
        return;
    }

    strcpy(szFileName, szTemp); // save new filename
    length = GetWindowTextLength(hEdit); // chars in edit control
    GetWindowText(hEdit, lpBuff, length+1); // retrieve text
    _lwrite(hFile, lpBuff, length); // write text to file
    _lclose(hFile);              // close the file
    SetWindowCaption(szFileName); // update title bar
    SendMessage(hEdit, EM_SETMODIFY, 0, 0); // clear change flag
}

//
// QueryWriteFile -- check if buffer has been changed, and if
// so prompt the user to write the file to disk.
//
VOID QueryWriteFile(HANDLE hEdit)
{
    if(SendMessage(hEdit, EM_GETMODIFY, 0, 0)) // was buffer changed?
    {
        if(MessageBox(hwnd, "File has been changed. Write file?",
            szAppName, MB_ICONQUESTION|MB_YESNO) == IDYES)
        {
            SendMessage(hwnd, WM_COMMAND, IDM_SAVEAS, 0);
        }
    }
}

//
// SetWindowCaption -- concatenate the filename with the application
// name, then update the frame window's title bar.
//
VOID SetWindowCaption(char * szFileName)
{
    char szTemp[EXEMANESIZE+1]; // filename scratch buffer

    strcpy(szTemp, szAppName); // get application name
    strcat(szTemp, " - ");      // add separator
    strcat(szTemp, szFileName); // add filename
    SetWindowText(hwnd, szTemp); // put result into title bar
}

```


Borland's C++ package, Charles Petzold's book, *Programming Windows*, and just about every other source of information about Windows programming you might stumble on.

There's no mystery to this: A Notepad clone provides easily understood and tested functionality, it tests the programmer's ability to process dialog boxes and menu selections, it illustrates how to perform basic file operations within Windows, and it's nearly trivial to implement because all of the grunt work of text display and editing can be dumped onto a multiline edit control. In his book *Advanced Windows Programming*, Martin Heller refers to programs like this as "toys," and rightly so. If you ever try to implement a real graphical editor in Windows that can efficiently handle files of an arbitrary size and display multiple fonts within a window, you'll soon understand how enormous the difference is between toys such as Notepad and an industrial-strength Windows application like *Word for Windows*.

Nevertheless, I think my own toy application, DLGDEMO, is worth your inspection. It shows how to initialize the OPENFILENAME structure and call the GetOpenFileName() or GetSaveFileName() function to obtain a valid filename. It demonstrates how to use the little-discussed Windows functions _lcreate, _lopen, _lread, _lwrite, and _lclose to perform traditional C-language stream file I/O to a memory block dynamically allocated with GlobalAlloc. And last but hardly least, it illustrates a vastly improved strategy for putting together a Windows application.

If you've studied the example programs in the time-honored Windows programming references, you've probably noticed that the traditional way to handle the various window messages passed to the application's callback routine is to decode the messages with elaborate (and sometimes nested) switch { } statements. Because of the incredible variety of possible messages, particularly in the case of an application with a complex menu bar, these switch statements often result in a single callback function that drags on for literally hundreds of lines. (See, for example, the Microsoft source code for the DefWindowProc() function.) This anti-modular, antistructured approach to handling messages flies in the face of good programming style in C or any other language; it interferes with code readability,

code maintenance, and code reuse. Even the Windows CASE tools, which have no particular obligation to adopt this technique over any other, generate source code based on the same old ugly, convoluted switch statements.

In DLGDEMO, you'll see that the callback function—FrameWndProc()—is table-driven and very short. It looks up each message in a structure called messages[], which associates the message number with the address of a function that can handle that message. If the message number is not found in the table, FrameWndProc() calls the Windows function DefWindowProc() to perform the default processing of the message:

```
struct decodeWord {
    WORD Code;
    LONG (*Fxn) (HWND, WORD, WORD,
        LONG);
};
```

```
struct decodeWord messages[] = {
    WM_CREATE, DoCreate,
    WM_INITMENU, DoInitMenu,
    WM_SETFOCUS, DoSetFocus,
    WM_SIZE, DoSize,
    WM_COMMAND, DoCommand,
    WM_DESTROY, DoDestroy,
};
```

```
LONG FAR PASCAL FrameWndProc(HWND
    hWnd, WORD wParam, WORD lParam,
    LONG lParam)
{
    int i;
    for(i = 0; i < dim(messages);
        i++)
    {
        if(wParam == messages[i].Code)
            return((*messages[i].Fxn) (hWnd,
                wParam, lParam));
    }
    return(DefWindowProc(hWnd,
        wParam, lParam));
}
```

WM_COMMAND messages, which are sent to the FrameWndProc() function whenever the user selects an item from the menu bar, are handed off by FrameWndProc() to a function called DoCommand(). Like FrameWndProc(), the DoCommand() function is table-driven. It looks up the menu item's ID in a structure called menuitems[] that associates the menu item with the address of

a function for that menu item:

```
struct decodeWord menuitems[] = {
    IDM_NEW, DoMenuNew,
    IDM_OPEN, DoMenuOpen,
    IDM_SAVE, DoMenuSave,
    IDM_SAVEAS, DoMenuSaveAs,
    IDM_EXIT, DoMenuExit,
    IDM_UNDO, DoMenuUndo,
    IDM_CUT, DoMenuCut,
    IDM_COPY, DoMenuCopy,
    IDM_PASTE, DoMenuPaste,
    IDM_DELETE, DoMenuDelete,
};
```

```
LONG DoCommand(HWND hWnd, WORD
    wParam, WORD lParam, LONG lParam)
{
    int i;
    for(i = 0; i < dim(menuitems);
        i++)
    {
        if(wParam == menuitems[i].Code)
            return((*menuitems[i].Fxn) (hWnd,
                wParam, lParam));
    }
    return(DefWindowProc(hWnd, wParam,
        lParam));
}
```

The table-driven approach to message processing has several advantages. It encourages modularity and makes the program easier to read and understand. It predisposes the programmer to create short, very specific functions and to reuse code. It also makes extending the program for new messages and menu items much easier; you just add an entry to the appropriate table and write a specific function to handle the message or menu item. When the program is extended in this way, there is virtually no impact on the program's existing source code—and thus minimal opportunity to introduce new errors into the existing code.

We will be expanding the DLGDEMO program over the next couple of issues to demonstrate the use of some of the other common dialogs—and in the process, we hope, converting it from a toy into a full-fledged text editor.

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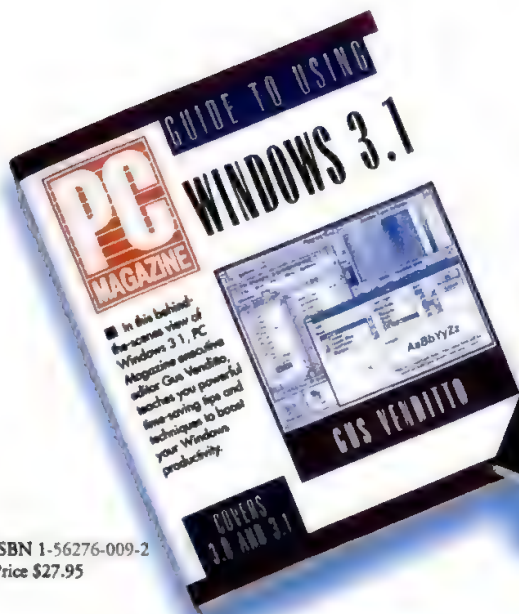


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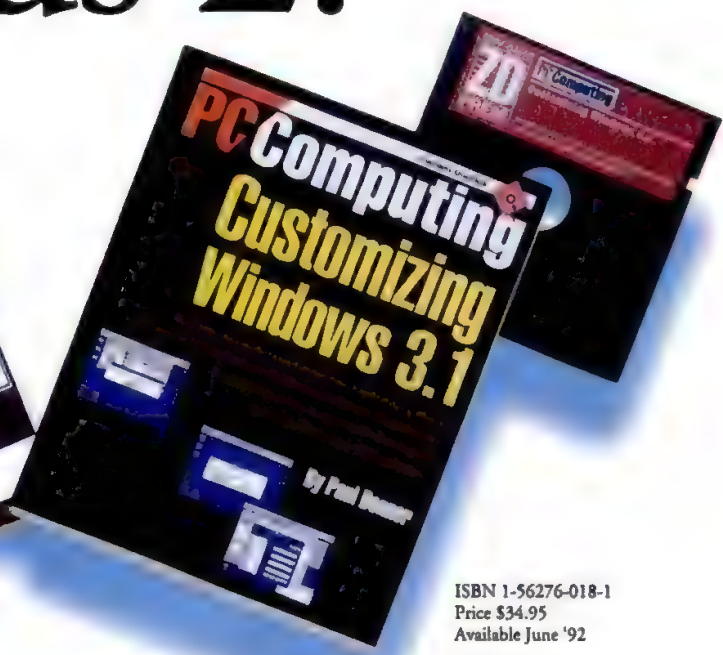
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CIRCLE 354 ON READER SERVICE CARD

by
Sal Ricciardi

Databases

DATE FIELDS IN PARADOX

Paradox is more versatile than most database packages in the range of dates it can accept. The year can range from 100 A.D. to the end of the tenth millennium! While this may benefit historians and science-fiction writers, it can cause problems for users with more mundane applications.

If you are using the *dd.mm.yy* date format (or the American *mm/dd/yy* format) and have set the display width of a date field in a form or report to eight characters, only the first two digits of the year are displayed. This means that if you mistype the date (for example, you intend 26 September 1991 but type "26.9.911"), you will see "26.09.91", making the error very difficult to detect.

The solution is to set lower and upper bounds on the date field: I suggest for a lot of applications 01/01/90 and 12/31/99. Any attempt to enter a date outside this range will immediately be detected as an error, and you will be forced to correct it before proceeding.

The procedure is as follows:

1. View the table concerned and move the cursor to the date field. Press F9 to enter edit mode.
2. Press F10 for the menu and select ValCheck and Define. Press Enter to select the field.
3. Select LowValue, type "1/1/90", and press Enter.
4. Repeat step 2, then select HighValue, type "12/31/99", and press Enter.
5. Press F2 to quit edit mode.

If you'll be using this procedure often, it would make sense to automate steps 2 to 5 with the script shown in Figure 1.

Graham Jeffery
London, England

■ **DATE FIELDS IN PARADOX:** Use lower and upper bounds to keep *Paradox* date fields in range.

■ **A FASTER STOD FUNCTION:** This user-defined function uses the *Clipper* Extend System to change date strings to variables.



It's easy to see how a mistyped date can go unnoticed when you set the column width to eight characters. If you enter more than two digits for the year, the extra digits will appear to have been chopped off. But they'll still be there, hidden from view.

Paradox lets you define validity checks for each field in your table. Setting a LowValue and a HighValue validity check for the date field helps keep the dates in range. I'm not sure I agree with Mr. Jeffery's use of 12/31/99 as the high value, since the year 1999 isn't really that far off. You might want to consider using a later date, such as 12/31/2099.

Another use for the LowValue and HighValue settings is to restrict a date so that it's not before or not after today's date. To do this, enter the reserved word TODAY for LowValue when you only want dates no earlier than the current date, or for the HighValue setting when you only want dates no later than the current date. You can also force the date

field to default to today's date by placing TODAY in the Default validity check setting.

Of course, your computer's system clock should be set to the correct date, or using TODAY will not work.

A FASTER STOD FUNCTION

In the October 15, 1991, *Databases* column, you published an STOD() function to convert a date string in the format *yyyymmdd* to a date variable. A much faster STOD() function can be created in *Clipper* by using C and the *Clipper* Extend System. Here's the code:

```
#include <extend.h>

CLIPPER STOD( VOID )
{
    _retnds( _para( 1 ) );
}
```

This creates STOD.OBJ, which you can link with your *Clipper* application. To use STOD(), just pass it a date string in the form "yyyymmdd", as in

```
STOD("19910228")
```

John Kaster
Alexandria, Virginia



This function is indeed significantly faster than the one I published earlier. According to my informal tests, in fact, it's about five times as fast.

To create the .OBJ for linking with your *Clipper* code, I used the following command line with Borland C++:

```
BCC -ml +STOD.CFG -c STOD.C
```

where STOD.CFG contained a line in the form

```
-IF: \CL501\INCLUDE;
```

The -ml option specifies the large mem-

DRANGE.SC

COMPLETE LISTING

```
DRANGE.SC - Set the date range allowed for a date field EditKey
Menu {ValCheck} {Define} Enter {LowValue} {1/1/90}
Menu {ValCheck} {Define} Enter {HighValue} {12/31/99}
Do_It!
```

Figure 1: A short *Paradox* script that sets the valid date range for a date field.

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PROGRAMMING

DATABASES

ory model, and the line above specifies the directory where the Extend System include files can be found.

The `_retds()` function, part of the *Clipper* Extend System, returns a date variable converted from a date string in the form "yyyymmdd". For example,

```
_retds( "19910930" )
```

returns the date 09/30/91.

The `_parc()` function returns a far pointer to the specified parameter. For example, `_parc( 1 )` will return a far pointer to the first parameter, `_parc( 2 )` will return a far pointer to the second parameter, and so on.

Therefore, if you call the `STOD()` function like this:

```
datevar=STOD( "19910930" )
```

then

```
_retds( _parc( 1 ) );
```

is equivalent to

```
_retds( "19910930" );
```

which returns the date 09/30/91. The `STOD.OBJ` file and the `STOD.C` source code are available on PC MagNet in `STOD.ZIP`.

To use `STOD` with your *Clipper* 5.0 applications, include `STOD.OBJ` after your application filename when linking as follows:

```
RTLINK FILE yourapp.obj,  
STOD.OBJ LIB  
CLIPPER, EXTEND
```

For *Clipper* Summer 87, substitute `PLINK86` for `RTLINK`.

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Share your database experience, tips, and techniques; we'll pay you \$50 for any submission we print. Mail your submission on-disk, accompanied by a printout, to Databases, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload it to PC MagNet (see page 10 for access instructions). You may also contact Sal Ricciardi via PC MagNet, mailbox 72241,33. We regret that we are unable to acknowledge submissions or answer questions individually. ■

Languages

BINARY VS. ASCII

Many numeric data files are written in an ASCII format, so they can be viewed with the DOS TYPE command or normal text editors. However, storing numeric values as text introduces two significant problems. The first is that many more bytes are needed to store the data than are actually necessary. The second problem is that reading and writing numbers as ASCII digits takes a lot longer than simply writing them in their native fixed-length form.

As an example, consider the integer

■ **BINARY VS. ASCII: Use binary files with BASIC to reduce file size and improve access speed.**

value -12345. When this number is written to disk using BASIC's PRINT # statement, 8 bytes of disk space are needed: 6 for the digits, and 2 more for the terminating

carriage return and line feed. Contrast that with the 2 bytes an integer actually occupies in memory. In addition, reading and writing this value takes longer. Since 8 bytes are required to store the number, more data must be read and that takes more time. And BASIC must examine every character it reads, as it looks for a delimiting carriage return or a comma. Then there is the additional time needed to convert the digits back to their native integer format. That is, the statement

```
INPUT #1, X%
```

is equivalent to

```
INPUT #1, Temp$: X% = VAL(Temp$)
```

One good solution is to use the binary file mode available in QuickBASIC, Version 4.x, and later. Data in a binary file is written using the PUT # command, which stores the variables in their native form rather than as a series of ASCII digits. To read a number from a binary file you use the GET # command. GET # knows the number of bytes to read, based on the target variable. For example, the line

```
GET #1, , A!
```

tells GET # to read the next 4 bytes in the file into the single precision variable A!. The data is read without regard to the meaning of the bytes, and without wasting time looking for a terminating carriage return or comma.

I've included a short program (see Figure 1) that demonstrates the difference in speed and file sizes between conventional sequential and binary-file access modes.

Brian A. Rock
Boulder, Colorado

```
BINARY.BAS - benchmark to compare Binary and Sequential access

Start! = TIMER
OPEN "STANDARD.DAT" FOR OUTPUT AS #1
FOR X% = 1 TO 5000
    PRINT #1, X%
NEXT
CLOSE #1
Done! = TIMER
PRINT USING "###.### seconds to write a sequential file"; Done! - Start!

Start! = TIMER
OPEN "BINARY.DAT" FOR BINARY AS #1
FOR X% = 1 TO 5000
    PUT #1, , X%
NEXT
CLOSE #1
Done! = TIMER
PRINT USING "###.### seconds to write a binary file"; Done! - Start!

Start! = TIMER
OPEN "STANDARD.DAT" FOR INPUT AS #1
FOR X% = 1 TO 5000
    INPUT #1, X%
NEXT
StandardLen% = LOF(1)
CLOSE #1
Done! = TIMER
PRINT USING "###.### seconds to read a sequential file"; Done! - Start!

Start! = TIMER
OPEN "BINARY.DAT" FOR BINARY AS #1
FOR X% = 1 TO 5000
    GET #1, , X%
NEXT
BinaryLen% = LOF(1)
CLOSE #1
Done! = TIMER
PRINT USING "###.### seconds to read a binary file"; Done! - Start!

PRINT "The standard sequential file is"; StandardLen%; "bytes long."
PRINT "The binary file is"; BinaryLen%; "bytes long."
```

Figure 1: This benchmark test program illustrates the tremendous speed and size savings that binary file access affords.



Using binary files intelligently can go a long way toward reducing the size of your data files, as well as the time needed to read and write them.

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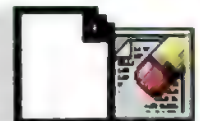
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When I compiled and ran the sample benchmark test program, it created the binary file about 15 percent faster than the sequential version. Even better, the binary file was read in less than one fourth the time. Perhaps most important, the size of the sequential file was more than 38K, as opposed to only 10K for its binary counterpart.

Note that when you need to save or load an entire numeric array, even greater speed improvements are possible using BSAVE and BLOAD. For example, to save a double-precision dynamic array

When you need to save
or load an entire
numeric array, greater
speed is possible
using BSAVE and
BLOAD.

containing 4,000 elements with element numbers starting at 1, you'd use the following:

```
DEF SEG = VARSEG(Array$(1))
BSAVE "ARRAY.DAT", 0, 32000
```

DEF SEG is used to tell BSAVE in which segment the array resides. BSAVE's second argument holds the starting address, which is always 0 for dynamic numeric arrays. The last parameter indicates the number of bytes to be written, based on 4,000 elements with a length of 8 bytes each.—*Ethan Winer*

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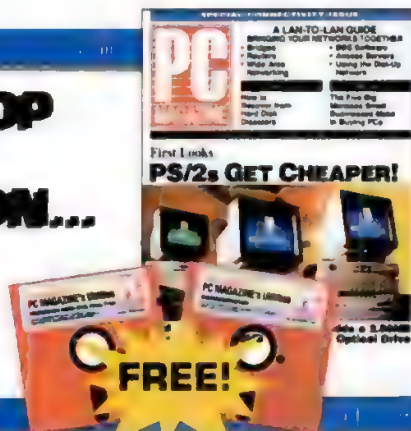
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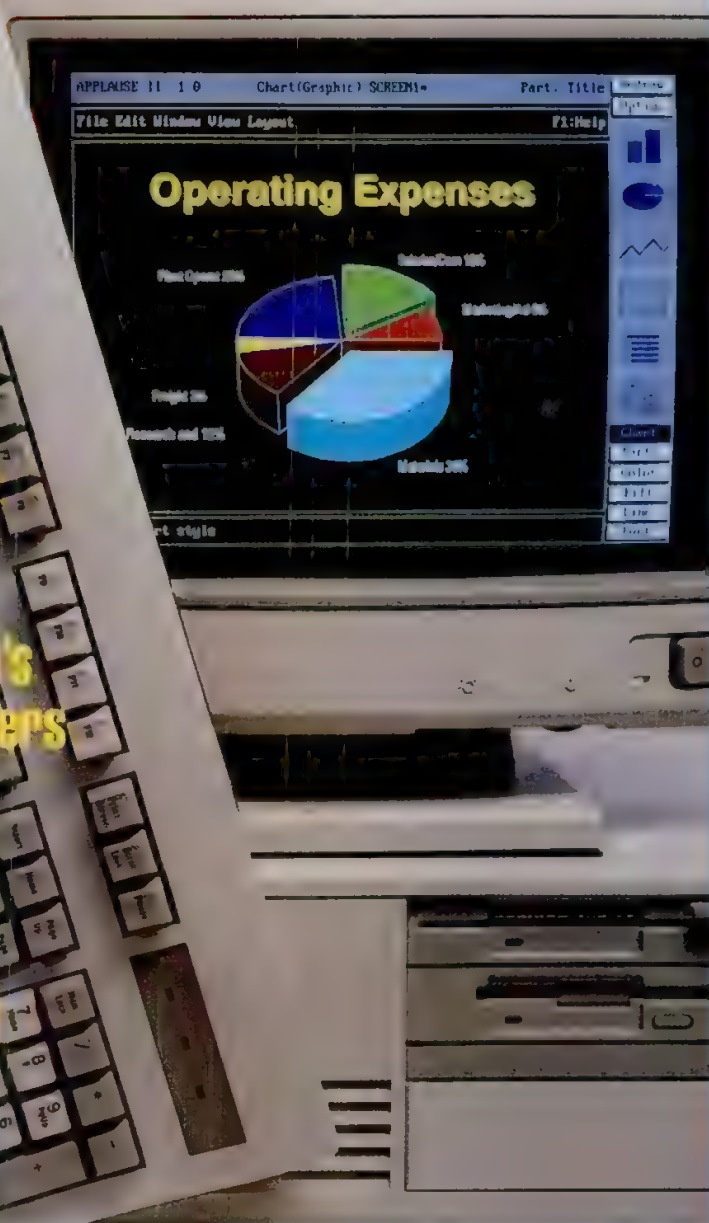
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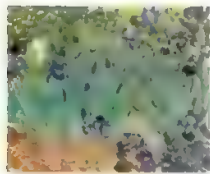
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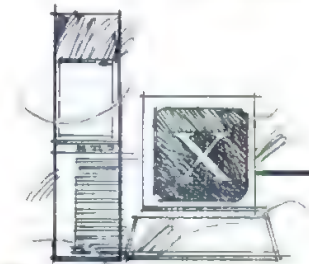


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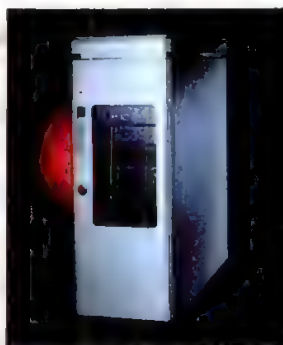


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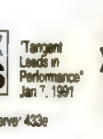
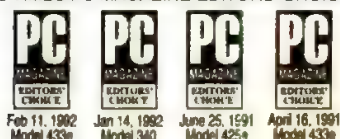
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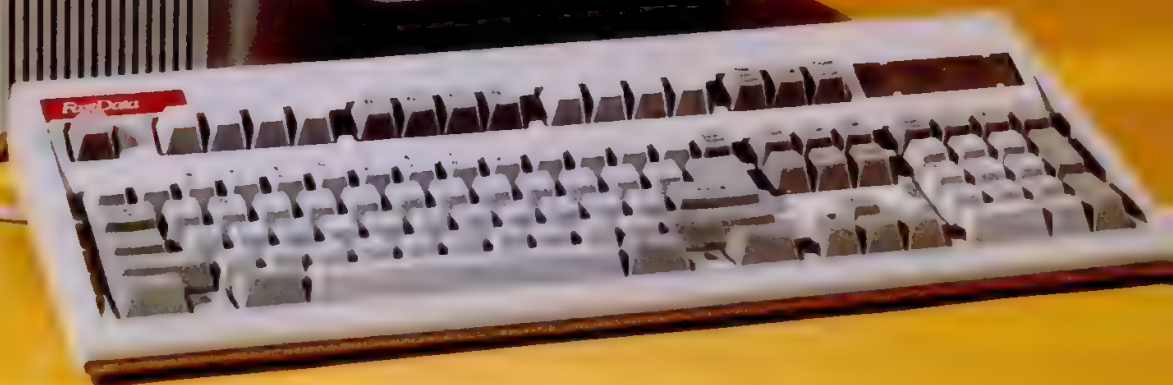


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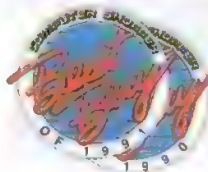
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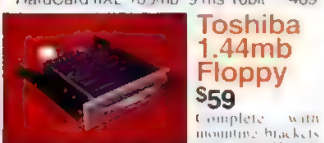
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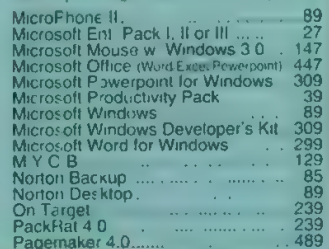
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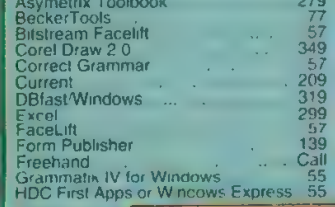
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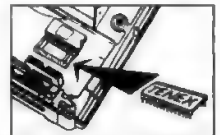
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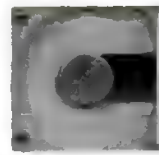
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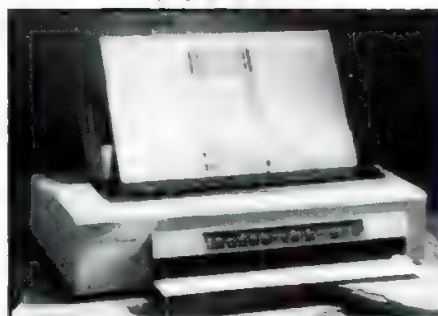
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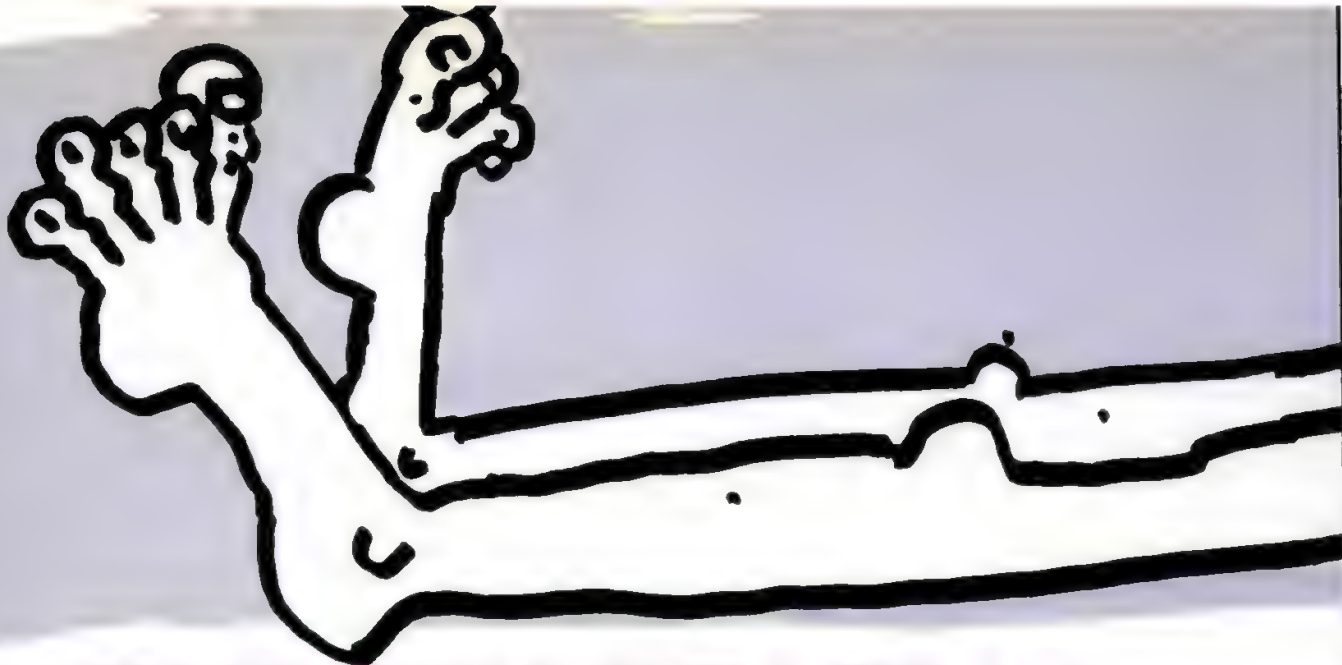
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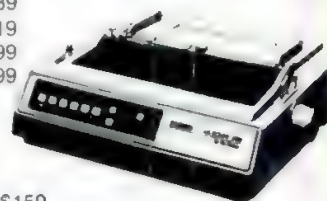
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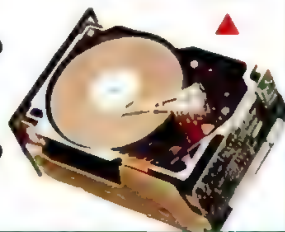
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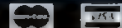
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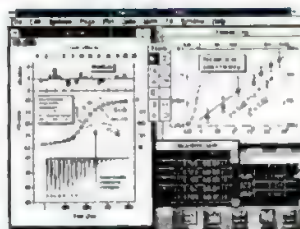


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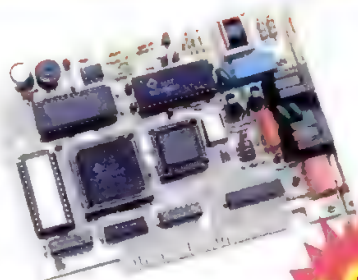
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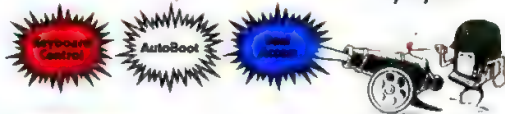
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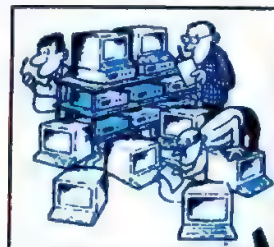
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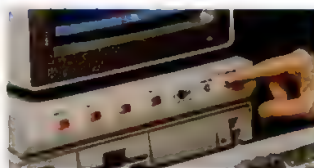
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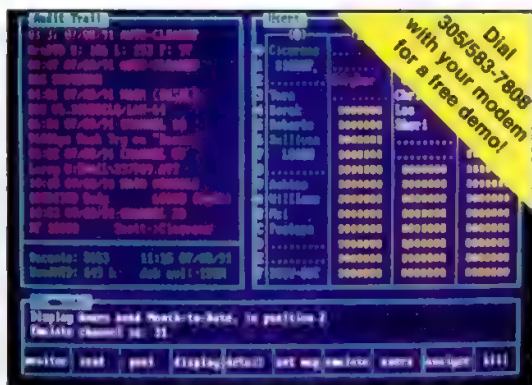
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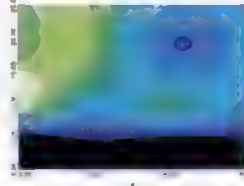
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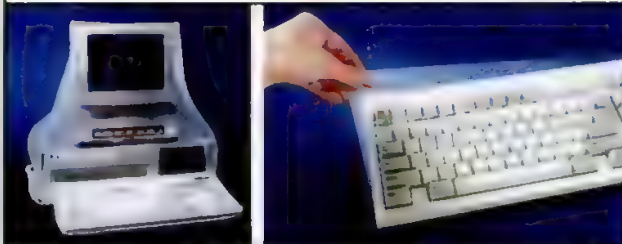
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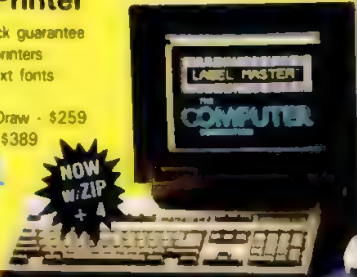
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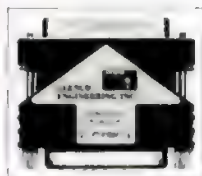
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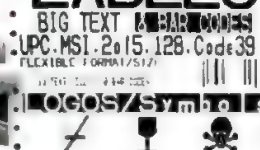
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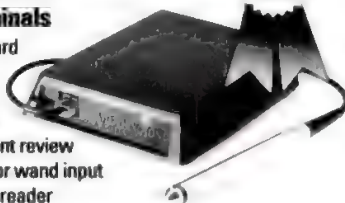
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PC 5/26-6

1. Do you work in a DP/MIS department?
01. ☐ Yes 02. ☐ No

2. Please indicate your company or organization's primary business activity: (Check one only.)

- 01. ☐ Manufacturer of Computer Equipment, Computers, Software
- 02. ☐ Manufacturer—Aerospace
- 03. ☐ Manufacturer—Other
- 04. ☐ Systems House
- 05. ☐ Computer Consultant
- 06. ☐ Computer Retailer/VAR/VAD Distributor
- 07. ☐ Communications
- 08. ☐ Finance/Banking/Insurance/Real Estate/Accounting
- 09. ☐ Education
- 10. ☐ Government—Federal
- 11. ☐ Government—Non-Federal
- 12. ☐ Research and Development
- 13. ☐ Data Processing/Computer Service
- 14. ☐ Health/Medical/Legal Service
- 15. ☐ Engineering/Architecture

16. ☐ Agriculture/Construction/Mining/Oil/Transportation/Utilities

- 17. ☐ Non-Computer Retailer/Distributor
- 18. ☐ Other Business or Service
- 99. ☐ Other

3. Please indicate your primary business function: (Check one only.)

- 01. ☐ DP/MIS
- 02. ☐ Systems, Programming
- 03. ☐ Communications
- 04. ☐ Engineering
- 05. ☐ Res./Dev./Scientific
- 06. ☐ Accounting/Finance
- 07. ☐ Computer Consulting
- 08. ☐ Purchasing
- 09. ☐ Operations
- 10. ☐ Production
- 11. ☐ Education/Training
- 12. ☐ Marketing/Sales
- 13. ☐ Medical/Legal
- 14. ☐ Admin./Mgmt.
- 99. ☐ Other

4. Is your company a reseller?
01. ☐ Yes 02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:

- 01. ☐ 10 or less 03. ☐ 26-99
- 02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply.)

- 01. ☐ Linked to mainframe
- 02. ☐ Linked to mini
- 03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)

- 01. ☐ IBM or Compatible PCs
- 02. ☐ IBM or Compatible Mainframes
- 03. ☐ IBM or Compatible Minis
- 04. ☐ Macintosh

8. Do you plan to buy any PC Products?
01. ☐ Now

- 02. ☐ In 4 to 6 months
- 03. ☐ In 7 to 12 months
- 04. ☐ No definite plans

9. Number of Employees in your entire company:

- 01. ☐ 25 or less
- 02. ☐ 26-99
- 03. ☐ 100-499
- 04. ☐ 500-999
- 05. ☐ 1000 or more

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036	037	038	039	040	041	042	043	044	045	046	047	048	049	050	051	052	053	054	055	056	057	058	059	060	061	062	063	064	065	066	067	068	069	070	071	072	073	074	075	076	077	078	079	080	081	082	083	084	085	086	087	088	089	090	091	092	093	094	095	096	097	098	099	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
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1. Do you work in a DP/MIS department? 01. ☐ Yes 02. ☐ No	16. ☐ Agriculture/Construction/Mining/Oil/Transportation/Utilities 17. ☐ Non-Computer 18. ☐ Retailer/Distributor 19. ☐ Other Business or Service 20. ☐ Other	4. Is your company a reseller? 01. ☐ Yes 02. ☐ No	8. Do you plan to buy any PC Products? 01. ☐ Now 02. ☐ In 4 to 6 months 03. ☐ In 7 to 12 months 04. ☐ No definite plans	9. Number of Employees in your entire company: 01. ☐ 25 or less 02. ☐ 26-99 03. ☐ 100-499 04. ☐ 500-999 05. ☐ 1000 or more
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■ 50-MHz 486 PCs

PC Magazine Labs tests 14 50-MHz 486-based speed demons, from ATronics, Axik, C² Micro Systems, Compaq, CUI, Dell, Diamond, Intelec, Mega Computer Systems, National Micro Systems, PCI, Polywell, Silicon Valley, and Sirius Systems Technology.

■ NETWORK OPERATING SYSTEMS

Selecting your network operating system may be the single most important business choice you ever make. We'll look at *LAN Manager*, *NetWare*, and *VINES*: the state of the art in no-f fooling, fire-breathing, big-time network operating systems.

■ WINDOWS IMAGE CAPTURE

If you constantly need to capture your computer screen for manuals, reports, and slide shows, then you need image-capture software. But under Windows, this comes with its own set of unique problems. *PC Magazine* rounds up nine packages, all of which tackle image capture under Windows.

■ MATH SOFTWARE

Scientists, engineers, and statisticians can now look to the PC for mathematical functions that were once the exclusive province of mainframes. *PC Magazine* reviews five interactive software packages that handle symbolic manipulation. The latest offerings from Calcode Systems, Soft Warehouse, Waterloo Maple Software, and Wolfram Research are included.

■ SOFTWARE SATISFACTION AND SUPPORT

What do you think of your software? *PC Magazine* asked users to rate their programs and the technical support that comes with them. Now the results are in. See which vendors are keeping users happy.

■ VISUAL DEVELOPMENT ENVIRONMENTS

The Visual Development Environment, or VDE, is an emerging category designed to make Windows programming easy. VDEs go a step beyond the familiar Integrated Development Environment, or IDE, by including an integrated screen designer. But are they as easy to use as they are reputed to be? We'll tell you what we found.

■ LAB NOTES

Microsoft Visual Basic lets BASIC programmers easily write true Windows applications. Just as the power of QuickBASIC was enhanced through the use of external libraries, Visual Basic can be expanded with dynamic link libraries. In the next two issues, we'll show you how to build DLLs to use with your Visual Basic programs.

■ UTILITIES

To illustrate Visual Basic as a productive Windows development environment, we will present a Visual Basic utility. MC.EXE is a replacement for the Program Manager. It combines some of the functionality of the File Manager and the Program Manager, giving you three ways to launch a program.

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Products for the Leisure Side of Personal Computing

PC Portfolio Management: Quant IX Helps Users Find Undervalued Stock



Investment analysis can be divided into two groups: fundamental and technical. The technical analyst believes the future can be predicted based on historical information, so technicians focus on charts, trends, and patterns. Fundamentalists look instead to profitability, liquidity, leverage, and activity. When they research specific companies, fundamentalists measure a company's returns on sales and investments, its ability to meet its short-term obligations, the extent to which the company's been financed by debt versus equity, and how effectively the corporation is using its resources.

The software available for the technician is simply as-

tounding. Programs like *CompuTrac* (\$900), *MetaStock* (\$349), and *MagaTech* (\$119) are comprehensive, flexible, and mature products that have been used and tested by thousands of investors. The tools for the fundamentalist are far less developed. After Hours takes a look at two of the best, *Quant IX Portfolio Evaluator* (\$129) and *Market Base* (\$59).

Quant IX functions as a portfolio manager and a stock analysis program. As a portfolio manager, it can monitor a variety of assets: cash, U.S. government bonds and bills, federal agency securities, tax-exempt bonds, corporate bonds, preferred stocks, mutual funds, common stocks, and other investments. It easily adjusts the portfolio for dividends, reinvestments, stock splits, and

stock dividends. Monitoring purchases, sales, market values, commissions, and gains and losses is simple. The five portfolio management reports include a transactions ledger, a report on sold positions, a current appraisal, an income report, and a summary of the cost basis of the securities.

STOCK ANALYSIS, TOO

As a stock analysis program, *Quant IX* has six valuation models to find undervalued stocks. These models derive an estimated intrinsic price and then compare that price with the actual market price. For example, the fundamental valuation model focuses on P/E (price/earnings) ratios to value common stocks. It derives a "normal" P/E ratio for a stock based on the current payout ratio, the security's estimated three- to five-year earnings growth rate, and the expected return of the security. I'll spare you all the formulas.

Another example is the modern portfolio theory model that arrives at a valuation based on past performance and future expectations. The calculation is based on an earnings multiplier, dividend projections, and the expected return as determined by the capital asset pricing model. The capital asset pricing model, which is the basis of modern financial theory, determines the expected rate of return of an asset, given the asset's level of risk.

Quant IX is easy to install. It is more difficult, but not excessively so, to set up the built-

FINANCE
Quant IX and Market Base Portfolio Management turn your PC into your broker.

BUSINESS
Bring better bargaining skills to the table with MagaTech Pro.

AUTO CARE
Road Selection Complete car care from mag to your last tune-up.

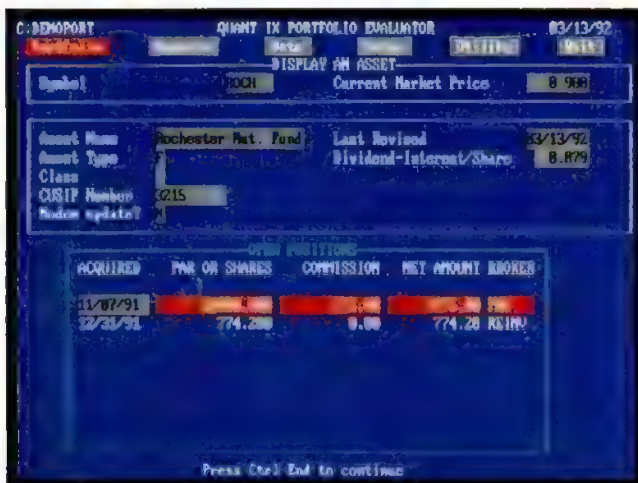
in communications for data retrieval from the CompuServe or Warner databases. Support for the program is also good. A change in CompuServe's software required a new file; this was available from both the Investment Forum on CompuServe and the free *Quant IX* bulletin board (414-961-2592).

If you want to improve your chances of maintaining your wealth and possibly increasing it, the *Quant IX Portfolio Evaluator* provides you with a number of valuable tools. Its combination of portfolio management and stock analysis in one package is a real advantage to the personal investor. Although the investment software available still favors the technical approach, *Quant IX* will impress the investors of the fundamental persuasion.

List Price: *Quant IX Portfolio Evaluator*, Version 4.0, \$129.

Requires: 640K RAM, 1.6MB hard disk space, DOS 2.1 or later. Quant IX Software, 5900 N. Port Washington Rd., #142-A, Milwaukee, WI 53217; 800-247-6354, 414-961-1991.

CIRCLE 326 ON READER SERVICE CARD



Quant IX Portfolio Evaluator offers portfolio management and stock analysis in a single software solution. Transactions are easy to record; here a quarterly dividend is reinvested into a mutual fund.

Market Base: Stock Analysis Software with Weekly Market Updates

FINANCE
by Tom Unger

Ever wondered how the stock you own is doing compared with the rest of its industry? Does it pay better than average dividends? Has it outperformed the market during the past quarter? The past year? The past five years?

Divining the answers to these questions has bedeviled even the most dedicated spreadsheet jockeys. But *Market Base*, a \$59 DOS-based stock analysis tool, obviates with minimal effort most of the drudgery associated with market analysis.

Market Base has two components. A database front end performs analysis that enables you to sort, cull, screen, and print out nearly any combination of stocks, stock averages, and comparisons, based on individual or grouped issues. The second component is the data itself, available from MP Software via subscription only.

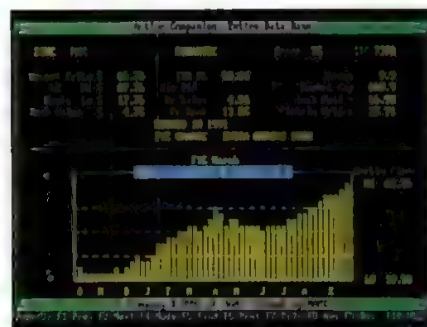
Market Base is a retrieval-

only system. You cannot enter updated values such as stock prices or price/earnings ratios on your own. Instead, as often as once a week, MP Software will send you an updated listing of as much data as you might ever want concerning the approximately 4,500 stocks listed on the NYSE, AMEX, and NASDAQ markets. The software's introductory package comes with the current week's information. Because that data contains information on stocks for the previous 60 months, there should be plenty of information to get almost any investor started. With the exception of stock prices, most stock information, such as price-to-equity ratios, dividends, and return on equity fluctuate little on a daily basis.

DATA FOR SALE

The subscription information—provided on a weekly, monthly, quarterly, or yearly basis—enables investors to determine their stocks' performance against those stocks' respective

Market Base provides not only the standard retinue of stock information, but graphs each issue's closing price for the previous 60 months and 52 weeks.



industries. In contrast to bulletin-board services, there are no on-line charges. Instead, subscription costs range from a yearly installment for \$125 to a weekly installment for \$2,300. MP Software says that most personal investors and managers of small funds need no more than monthly assessments to accomplish a variety of sophisticated analyses. And the company will customize a subscription schedule to meet any need.

The display subsystem lists individual stocks by company name or ticker symbol. It shows all the relevant information—high, low, close, 52-week highs and lows, fundamental relationships and ratios—as well as closing price trend graphs for the previous 60 months.

Market Base accepts user customization as well. It contains a value subsystem that lets you build macros to sort stocks, for example, by growth-in-market valuation. By creating a

term that divides earnings by price-to-equity ratios, you can establish a minimum growth threshold and view only those stocks that fall above the threshold. It can also export to a variety of file formats, including ASCII and .WKS, for further analysis.

For those looking for a way to organize their portfolios without having to hire a professional analyst, *Market Base's* \$59 introductory package provides the means to manage your stocks without breaking the bank.

List Price: *Market Base*, introductory package (with current week's database) \$59; weekly updates for one year, \$2,300; monthly updates, \$695; quarterly updates, \$345; yearly update, \$125. **Requires:** 256K RAM, 1.5MB hard disk space, DOS 2.0 or later. MP Software, 368 Hillside Ave., P.O. Box 37, Needham Heights, MA 02194; 800-735-0700, 617-449-8460.

CIRCLE 524 ON READER SERVICE CARD

Gain the Winning Edge At the Negotiating Table

BUSINESS
by Tom Unger

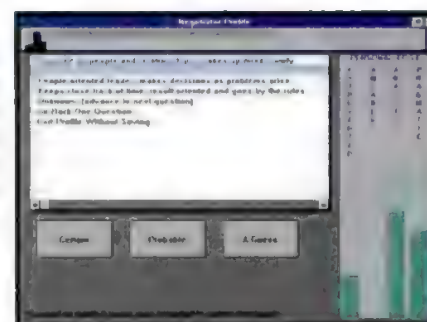
Those who negotiate the best agreements know not only which questions to ask their adversaries, but which questions to ask themselves. At significantly less cost than human negotiation consultants, Beacon Expert Systems' \$648 *Negotiator Pro* will help you ask yourself both sets of questions before you face your competition across the table.

This Windows-based program (DOS and OS/2 versions are also available) is designed to enhance your bargaining

skills based on an integrated set of negotiation principles, participant profiles, and pre-planned-question lists. *Negotiator Pro* incorporates research done on hundreds of negotiators and uses an expert system to determine likely outcomes based on a "win/win" strategy.

Negotiator Pro uses its expert system to build negotiation personality profiles of each participant. You must first build an assessment of your own negotiation personality via a prompted survey. You do the same on a best-guess basis for the other side. This process results in a bar-graphed analysis

Negotiator Pro uses an expert system to develop an analysis of each participant's personal and negotiation styles.



of all negotiators' personal and negotiating styles—for example, "cooperative and amiable," or "irritating and hostile." Click on the Interaction icon and a pop-up help screen will describe the likely outcome of your negotiation based on the two profiles. By matching profiles you can find the best mix to achieve your purpose, whether it's a simple lease or a

complex wage settlement.

Negotiator Pro provides a structure for planning your negotiation once you've profiled the parties (you can add parties later as they step into the talks, too). For simpler negotiations, *Negotiator Pro* provides a list of ten basic questions, each with an associated checklist of possible answers.

CONTINUES

After Hours

Negotiator Pro

CONTINUED

Imagine you are thinking of asking the boss for a raise. As you begin to plan your negotiation, you'll need to define your interests. *Negotiator Pro's* "Your interests" question checklist contains everything from "financial security" to "more free time." For more complex negotiation plans, you can use the 35-question list. As you add data based on each question to your overall plan, you're creating a printable document that can be used as a script during the session.

Negotiator Pro's extraordi-

nary hypertext help facility covers each phase of the planned negotiation and includes definitions of key terms, techniques, and advice on how to recognize and capitalize on typical negotiating plays.

Officials at Beacon Expert Systems say they are working on export links to Windows-based spreadsheets and word processors. *Negotiator Pro* provides excellent structural and psychological guidance for negotiators at a low cost and with relative simplicity.

List Price: *Negotiator Pro*, \$648; DOS version, \$499.

Requires: Windows 3.0 or later. Beacon Expert Systems Inc., 35 Gardiner Rd., Brookline, MA 02146; 800-448-3308, 617-738-9300.

CIRCLE 828 ON READER SERVICE CARD

Road Scholar: Nuts and Bolts Car Maintenance, Precise Record Keeping

AUTO CARE
by Fredric Burke

Car care often seems to fall into the same category as cleaning your home's gutters: a time-consuming and grimy necessity. This care often takes the form of dropping the car off at the dealership for a quick oil change, but keeping track of service is an important part of maintaining your car and enhancing its resale value. *Road Scholar* has adapted its commercial car and truck fleet management software to the needs of a single user; the \$59.95 *Road Scholar Vehicle Care Software* is a very effective means of keeping track of your car's maintenance requirements and history.

You can go one of two routes in utilizing *Road Scholar*: If you want to simply track basic vehicle information, you can go to "Going for a Drive" and start working; if you want to keep track of nearly every aspect of your car's maintenance history, you can use the Preventive Maintenance Setup as a jumping-off point for comprehensive record keeping.

Using *Road Scholar* is easy. Basic controls for the screens are limited to what *Road Scholar* calls its "button bar"; essentially, a function-key listing at the bottom of the screen. You either hit the appropriate function key or click on it with a mouse.

Road Scholar's operations are broken down into a series of

menu-driven modules that allow you to keep close track of the various duties of car ownership, all of which are accessed from the main menu's three categories: Vehicle Information; Reports, Graphs and Analyses; and Setup and Utilities. These are in turn broken down into submenus, each going into greater detail concerning their respective categories. For instance, in the Mileage Information category, you can track not only your gas consumption in miles per gallon (mpg), but also in mpg per month.

If all of this seems a bit overwhelming, you should start off with *Going for a Drive*, which is not only *Road Scholar* at its simplest but is also one of the best tutorials I've ever used. It's great because the tutorial itself takes you directly into the application. You can choose to enter either basic vehicle information or everything from the vehicle's identification number to the due date of your next insurance premium.

Originally, I wanted to use *Going for a Drive* just to enter general information for my car. I also wanted to try *Road Scholar's* basic functions to get a feel for the program. An hour later, I was trying to remember

the brand of oil I had put in the car the week before and how many gallons of fuel it took at my last fill-up. I felt completely comfortable with the software.

Using *Road Scholar* is more than just keeping track of your car at home; you can also generate and print expense reports for business purposes. And *Road Scholar* can build separate files for each car you own. On-line help is massive, complete, and helpfully cross-referenced; the manual is excellent.

One annoying part of *Road Scholar* is the advertising that accompanies the package's opening sequences. That aside, *Road Scholar* has the ability to store and collate a staggering amount of information. For the forgetful or for the procrastinator, its completeness is a boon. *Road Scholar* will keep track of just about everything, including when your next car payment is due. Too bad it can't write the check.

List Price: *Road Scholar*

Vehicle Care Software, \$59.95.

Requires: 640K RAM, 1.5MB hard disk space, DOS 3.1 or later. *Road Scholar Inc.*, 2603 Augusta #1000, Houston, TX 77057; 800-443-7623, 713-266-7623.

CIRCLE 822 ON READER SERVICE CARD

Pixound Graphics Player Turns Colors into Music



The relationship between music and color has fascinated musicians and theorists for centuries. Cilantro Computing Services' *Pixound*, billed as a "musical graphics player," brings this relationship into focus by using the colors of on-screen images to generate sounds with engrossing results.

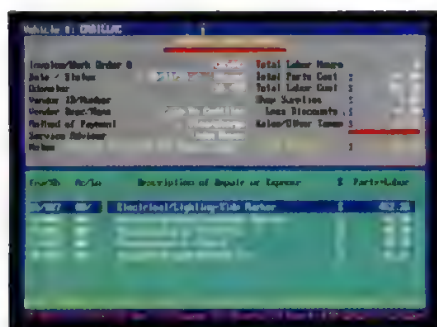
Pixound works by "composing" programs such as Twelve Tone Systems' *Sound Globes*. It combines predefined musical materials, variable parameters, and randomization functions to generate music from a MIDI synthesizer hooked up to a Roland MPU-401 or compatible MIDI interface. What makes this package

unique is that one of the parameters governing the audio output is the red/green/blue ratio of the pixel at the cursor location.

The music consists of three-note chords—one note each for red, green, and blue. As the intensity of these three base colors increases or decreases from pixel to pixel, the three harmonic voices rise or fall.

To kick off your audiovisual explorations, *Pixound* comes with a library of images including bitmapped versions of paintings by van Gogh, Degas, and Monet. Also, a number of random-image generators will fill the screen with different geometric patterns—a "lava lamp" effect that is fascinating to watch. You can import your own .PCX or TIFF files, too.

CONTINUES



Road Scholar lets users keep track of their vehicle's maintenance history simply by filling in the categories on the screen.

After Hours

Pixound

CONTINUED

To "play" the images, you move the cursor across the screen with the mouse. Or you can turn on an Autoplay function that will move the cursor either randomly or in patterns you define. You can even save each performance for posterity as a standard MIDI file.

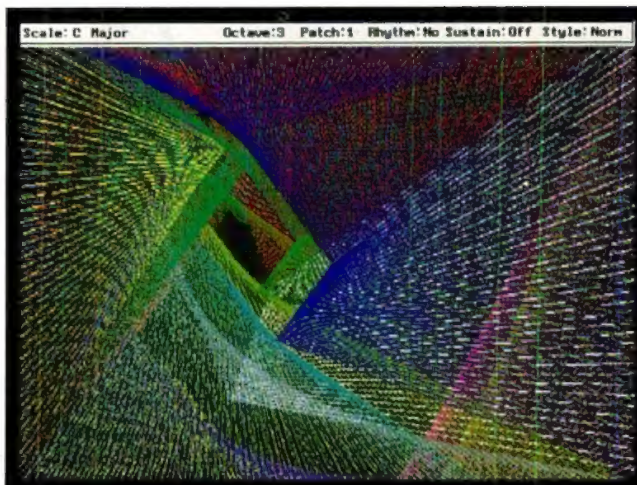
Most of the keys on the keyboard are assigned to different musical parameters that you can change while the music is playing, turning the keyboard into a musical instrument of the most unusual variety. One row of keys changes the type of scale or mode that underlies the harmonies, another changes the instrumental combinations, while still other keys transpose pitches or alter the rhythm in various ways.

An additional way to shape

your audiovisual output is to shift the image's color palette while the music plays. You can darken, lighten, or invert the palette, or choose new ones at random. Instructing *Pixound* to cycle continuously through different palettes produces mesmerizing results—including the illusion of motion.

If you want greater control over your musical materials, a number of *Pixound*'s configuration screens let you create your own rhythms, change the tempo of Autoplay, and assign a range of instrumental timbres to each of the three musical voices (the default timbres are optimized for the Roland LAPC card). You can't connect specific harmonies with specific colors, however, which would let you assign "warm" sounds to "warm" colors to create more meaningful aesthetic relationships.

The skimpy documentation makes it extremely difficult to understand fully how *Pixound*'s configuration settings work or



In addition to translating the color patterns into musical phrases, *Pixound*'s random-image generators produce engrossing patterns that will elicit music from a synthesizer.

how the different playback parameters affect the music. But most users will be having too much fun to really care. *Pixound* offers a unique audiovisual experience that can prove quite addictive.

List Price: *Pixound*, Version 2.1, \$79. **Requires:** 640K RAM,

2.1MB hard disk space, DOS 3.3 or later, mouse, Roland MPU-401-compatible MIDI interface and MIDI synthesizer recommended. Cilantro Computing Services Inc., 2277 W. Hwy. 36, #224, St. Paul, MN 55113; 612-636-5777.

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Abort, Retry, Fail?

The Lighter Side of Personal Computing



Paris bureau chief Frederick Ungeheuer works on a file on his personal computer; it will be delivered by modem over a telephone

According to *Time Insider* (January 27, 1992), a supplement for *Time* magazine subscribers, this is a personal computer. Looks more like a printing terminal to us. Appropriately, it's shown in a story describing the difficulties international *Time* correspondents encounter in getting their stories back to headquarters.



CARTOON: RICHARD TENNANT

Ad for PC Warehouse, Whitehall, Pennsylvania

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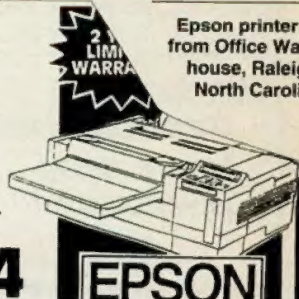
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Epson printer ad from Office Warehouse, Raleigh, North Carolina

Mea Culpa

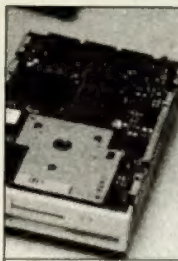
"Stac estimates there are now more than a million tape drive manufacturers using their compression chips."

—PC Magazine, January 28, 1992

A-Tronic Computer, City of Industry, California, offers its ATC 386-33 with a "Baby Desk Top Care."

—Computer Shopper, December 1991

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Data Reliability	< 1 unrecoverable error per 10 bits
Seek Errors	< 1 error per 10 seeks
Average Seek Time	80m Sec.
Disk Transfer Time	1.6 MB/S
Formatted Capacity	20.8 MB
R/W Heads	2 ea.
Drive Dimensions	1" h x 4.0" w x 5.91" d

The data reliability rate quoted in the Personal Computing Tools catalog (Los Gatos, California) could stand improvement.

If your entry is used in Abort, Retry, Fail? we'll send you \$50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of each entry are considered. Winners this issue: Thomas A. Balga (*Time Insider*), Marty Steele (printer shaving), Chuck Bonner (million manufacturers), Virgil Bailer (baby desk top care), Murray L. Lesser (data reliability), Mike Baaca (sealable forts).

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